NONNUCLEAR WEAPON DELIVERY MANUAL (AIR-TO-AIR)

USAF SERIES F-15C AND F-15D AIRCRAFT

McDonnell Aircraft
F33657-79-C-0779

This publication supersedes TO 1F-15C-34-1-1S-2.

This publication is incomplete without TO 1F-15C-34-1-1-1, TO 1F-15C-34-1-1-2, and is augmented by TO 1F-15C-34-1-2.

Commanders are responsible for bringing this publication to the attention of all affected personnel.

Basic and all changes have been merged to make this a complete publication.

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Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion affected by the latest change is indicated by a vertical line in the outer margin of the page.

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Change . . . 6 . . 15 Mar 81

Total number of pages in this manual is 132 consisting of the following:

Zero in this column indicates an original page.

TABLE OF CONTENTS

*No data applicable to these sections

SCOPE

TO 1F-15C-34 series manuals contain data describing the F-15C and F-15D weapon systems, the supporting equipment, and the munitions designated for carriage on the aircraft. The following manuals are also provided to establish present -34 series.

CONFIDENTIAL SUPPLEMENTAL MANUAL, TO 1F-15C-34-1-1-1

This manual contains confidential descriptive and procedural data pertaining to F-15C/D systems and munitions equipment. Some unclassified data remains in the manual to maintain descriptive continuity.

SECRET SUPPLEMENT, TO 1F-15C-34-1-1-2

This manual contains secret descriptive and procedural data pertaining to F-15C/D systems and equipment.

CHECKLIST, TO 1F-15C-34-1-1CL-1

The unclassified checklist contains abbreviated versions of all aircrew procedures written in this manual.

TO 1F-15C-34-1-2

This manual contains all air-to-ground (A/G) weapon delivery data.

TO 1F-15C-34-1-2CL-1

This manual contains an abbreviated version of all aircrew procedures in TO 1F-15C-34-1-2.

ARRANGEMENT, TO 1F-15C-34-1-1

This manual contains all air-to-air (A/A) weapon delivery data.

Section I is divided into 5 parts according to the following aircraft and equipment categories:

Part 1 Aircraft Weapon Systems
Part 2 Weapon Employment
Part 3 Suspension Equipment
Part 4 Aircraft Weapons
Part 5 Combat Support Systems

SECTION I, DESCRIPTION. This section contains a description of the A/A weapons, weapon systems, cockpit panels and controls, and various delivery modes obtainable using these systems.

SECTION II, NORMAL PROCEDURES. This section contains the normal aircrew procedures employed in A/A weapon delivery operations using the munitions and systems described in section I.

SECTION III, EMERGENCY PROCEDURES AND ABNORMAL OPERATIONS. This section contains the weapon jettison procedures, fire fighting and evacuation data, and avionics failure data. Emergency procedures are identified by black diagonal stripes on three sides of each page.

SECTION IV, SUPPLEMENTARY DATA. This section contains an error analysis of the various parameters that affect bombing accuracy and includes weapon harmonization/boresight data.

SECTION V, PLANNING PROCEDURES AND SAMPLE PROBLEMS. There is currently no data applicable to this section.

SECTION VI, PLANNING CHARTS AND TABLES. There is currently no data applicable to this section.

EXTERNAL STORES LIMITATIONS

See Flight Manual TO 1F-15C-1 for the limitations associated with carrying, releasing, and jettisoning of weapons.

AIRCRAFT EFFECTIVITIES, BLOCK, AND SERIAL NUMBERS

Statements regarding aircraft effectivities are added to text and illustrations when aircraft differences must be noted. For example, the notation:

F-15C-21 thru -23

means that the data applies only to the aircraft in blocks 21 through 23. The notation:

F-15C-22 (78-0498) and up

means that the data effectivity begins within block 22, and starting at aircraft number 78-0498. If the user wishes to determine the specific aircraft involved, the Block/Serial Number Conversion Table in these pages may be referenced.

TECHNICAL ORDER SUMMARY

The alphanumeric listing provided in subsequent pages contains all current technical directives that have been incorporated in any one or all -34 series manuals. The directives are repeated in a comparable list in those manuals where the data is actually described. When a directive is rescinded, the word "Rescinded" will follow the TO number and any reference to the number is deleted from the text.

YOUR RESPONSIBILITY – TO LET US KNOW

Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. Corrections shall be submitted on AF Form 847 and forwarded through your Command Headquarters to Hq ASD, Wright-Patterson AFB, Ohio, 45433 Attn: TAFA.

MANDATORY PROCEDURES

The words "shall" and "will", when used in aircrew procedures sections of this manual, indicate instructions to the aircrew that are mandatory.

AUTHORIZATION FOR LOCAL REPRODUCTION

Local reproduction of all charts, tables, forms, and any data based on the content of this manual, the classified supplements, and the checklist is authorized.

CHANGE SYMBOL

The change symbol, as illustrated by the black line in the outer margin of this paragraph, indicates significant text and illustration changes made to the current issue.

PUBLICATION DATE

The publication date that appears on the title page represents the currency of the data contained in the manual. When reference to this manual is made, the publication date (which includes the date of the latest change) should be used. (The publication date is not the printing or distribution date.)

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to Warnings, Cautions and Notes found throughout the manual.

WARNING

Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which will result in damage to equipment if not carefully followed.

NOTE

An operating procedure, technique, etc., which is considered essential to emphasize.

TECHNICAL ORDER SUMMARY

The Technical Order Summary lists only those technical orders which affect this manual.

Technical Order	ECP	Title	Production Effectivity	Retrofit Effectivity
1F-15-595	0888 1462	AIM-7 Tone Modulator Add RAM to PSP	F-15C-27 (80-0008) F-15D-28	F-15C-21 thru -27 (80 -0007) F-15D-21 thru -27
1F-15-606	937	Add programmable signal processor (PSP) and 98K radar data processor	F-15C-23 (78-0546) F-15D-23 (78-0574)	F-15C-21 thru -23 (78 -0545) F-15D-21 thru -23 (78 -0573)
1F-15-618	1029 and 1097	CC OFP update and AIM-9J-2/-3/P-2/-3 missiles	F-15C-26(79-0072) F-15D-27	F-15C-21 thru -26 (79 -0071) F-15D-21 thru -26
1F-15-651	1159	EWWS enable sw Mod (TO 1F-15C-34-1-1-2)	F-15C/D-23	F-15C/D-21 and -22
1F-15-737	1413	Radar data processor update	F-15C-25(79-0055) F-15D-25 (79-0011)	F-15C-23 (78-0546) thru -25 (79-0054) F-15D-23 (78-0574) thru -25 (79-0010)
1F-15-755	1428	AIM-7F Tune software change	F-15C-26 (79-0072) F-15D-27	F-15C-21 thru 26 (79 -0071) F-15D-21 thru 26
–	1404	LAU-114 Nose fairing release pin	–	
11L1-2-14-502	–	Deactivate LAU-114 Launcher Jettison Circuit	–	–
11L1-2-14-503	1288	Detent Locking Pin LAU-114 Launcher	–	–
–	1000	Delete HUD camera	F-15C/D-24	–
–	1046	Video Tape Recorder (VTR) replaces HUD camera	F-15C/D-24	–

BLOCK/SERIAL NUMBER CONVERSION

	AIR FORCE SERIAL NUMBER	
BLOCK NUMBER	F-15C AIRCRAFT	F-15D AIRCRAFT
F-15( )-21	78-0468 thru 78-0495	78-0561 thru 78-0565
-22	78-0496 thru 78-0522	78-0566 thru 78-0570
-23	78-0523 thru 78-0550	78-0571 thru 78-0574
-24	79-0015 thru 79-0037	79-0004 thru 79-0006
-25	79-0038 thru 79-0058	79-0007 thru 79-0011
-26	79-0059 thru 79-0081	79-0012 thru 79-0014
-27	80-0002 thru 80-0023	80-0054 and 80-0055
-28	80-0024 thru 80-0038	80-0056 and 80-0057

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SAFETY/OPERATIONAL SUPPLEMENT SUMMARY

The following list contains: the previously cancelled or incorporated Safety/Operational Supplements; the outstanding Safety/Operational Supplements, if any; and the Safety/Operational Supplements incorporated in this issue. In addition, space is provided to list those Safety/Operational Supplements received since the latest issue.

NUMBER	SUBJECT OR DISPOSITION
TO 1F-15C-34-1-1S-1	Previously Cancelled or Incorporated.
TO 1F-15C-34-1-1S-2	Incorporated.

SECTION I
DESCRIPTION

PART 1 AIRCRAFT WEAPON SYSTEMS

TABLE OF CONTENTS

AIRCRAFT WEAPONS CAPABILITIES

The weapons avionics in this aircraft provide a wide range of attack capabilities. The primary air-to-air (A/A) attack modes include the employment of the AIM-7F medium range missile (MRM), the AIM-9J/P series and AIM-9L short range missiles (SRM), and the 20 MM gun. A secondary capability includes the automatic or manual release of air-to-ground (A/G) munitions. Refer to TO 1F-15C-34-1-2. The A/A weapon carriage capabilities are shown in figure 1-1.

ATTACK MODE AVIONICS

The pilot performs weapon arming and weapon status monitoring for all weapons through the armament control set (ACS). The radar set provides acquisition and tracking of a single airborne target. Weapon attack steering and target information is displayed on the head-up display (HUD) and on the vertical situation display (VSD). Radar and weapon controls that require continuous access throughout an attack sequence are located on the control stick and throttles. See figure 1-2 for equipment location.

STATION DIAGRAM

A/A WEAPONS

MRM
FUSELAGE STATIONS
3, 4, 6, 7

SRM
WING STATIONS 2, 8

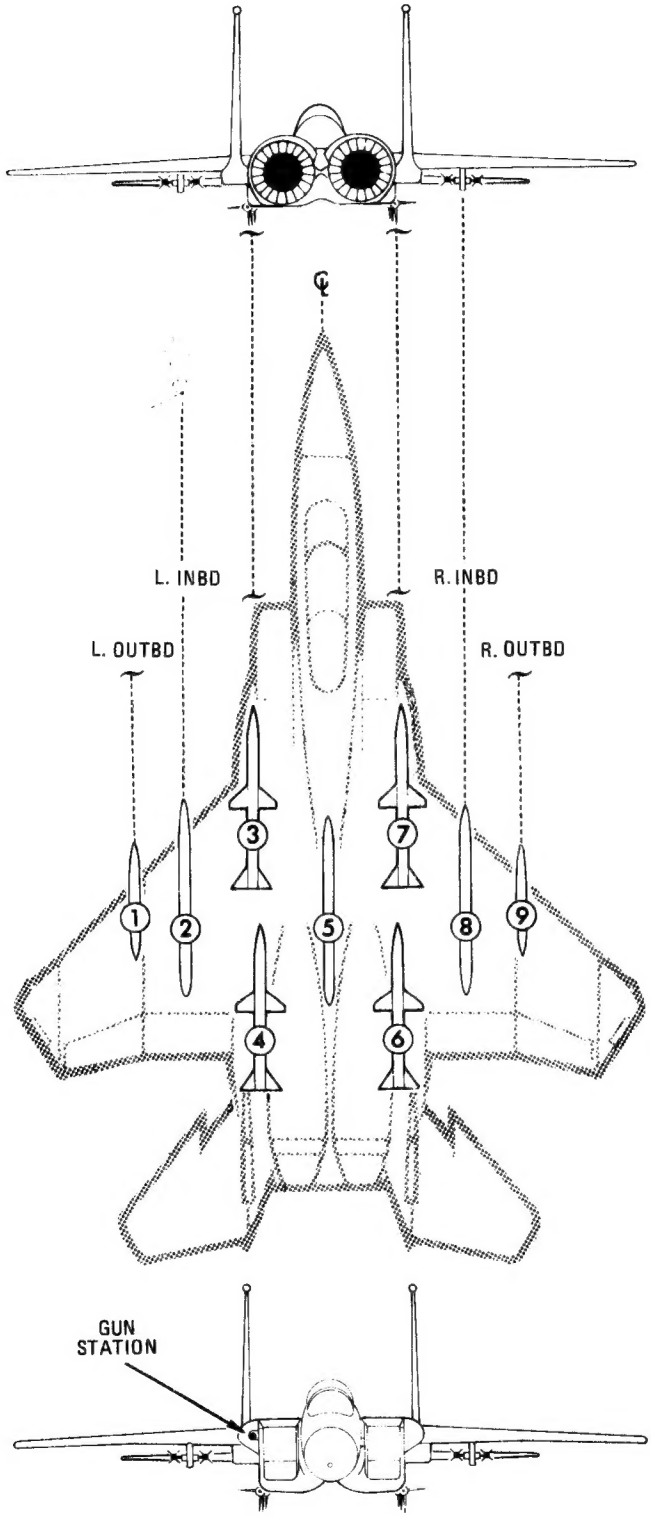

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Figure 1-1

FIRE CONTROL & DISPLAY SYSTEMS

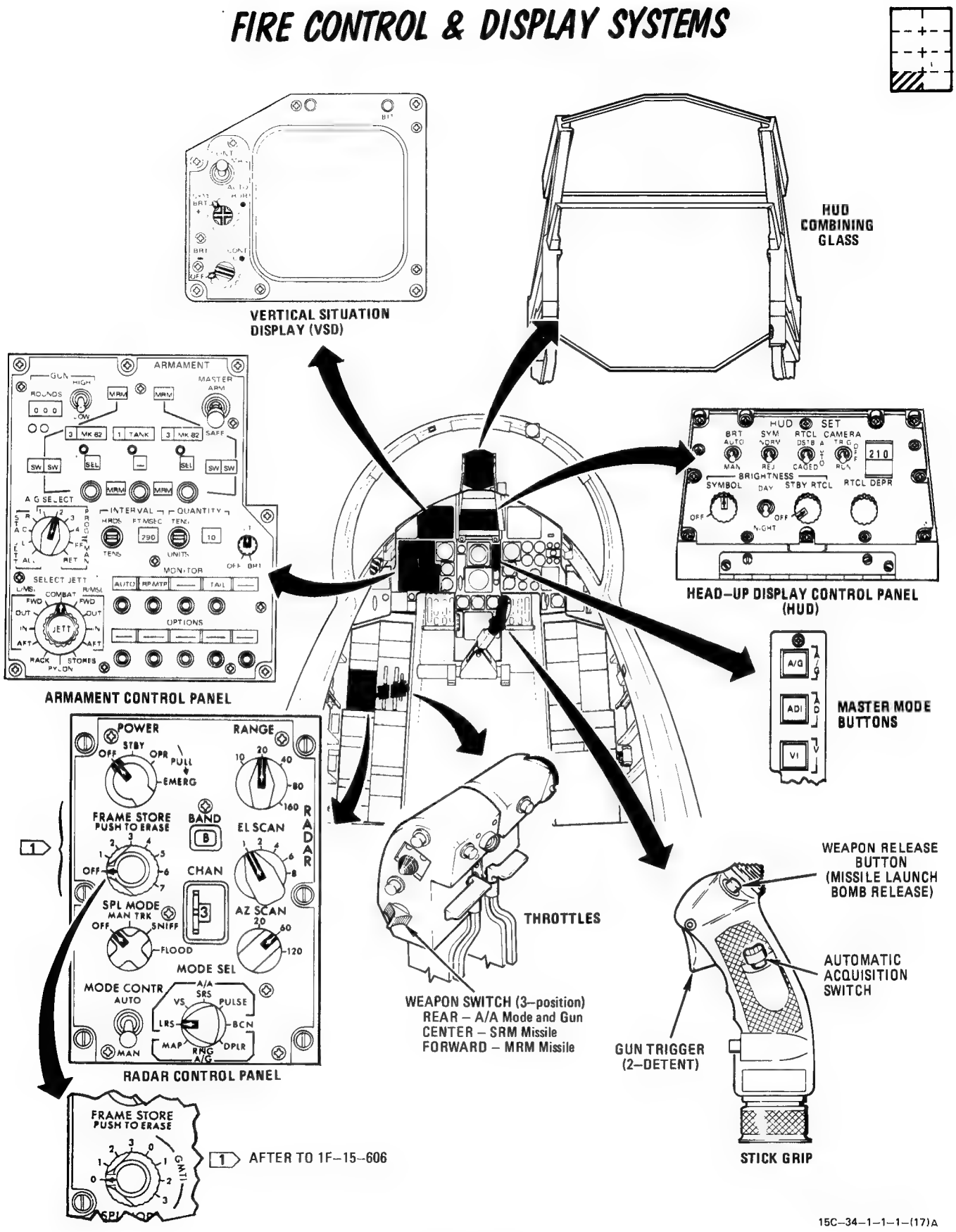

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Figure 1-2

Additional avionic systems utilized in weapon operations are briefly described in the following paragraphs.

CENTRAL COMPUTER (CC)

The CC is a digital computer which commands and receives flight data from the aircraft sensors, computes all attack steering, tracking and weapon launch parameters, and controls the display of this information on the HUD and VSD. The involvement of the CC in the A/A attack modes is described throughout this manual. For a detailed description of the CC, refer to TO 1F—15C—2—16—1.

AIR DATA COMPUTER (ADC)

The ADC is a digital computer which provides true airspeed (TAS), air density, and angle of attack (AOA) information to the CC for use in computing gun mode steering and MRM prelaunch parameters.

INERTIAL NAVIGATION SET (INS)

The INS is the primary source of attitude, true heading, and present position information. The INS provides pitch, roll, heading and inertial velocities to the CC for use in weapon launch computations and to the radar set for antenna stabilization and ground clutter rejection.

NCI Panel

After TO 1F—15—618, the CC has two sets of launch boundary equations for the AIM—9J/P series missiles. One set is based on the performance of the MK—17 rocket motor; the other is based on the SR—116 motor. The respective missiles are as follows:

a. AIM—9J/J—1/P/P—1 with the MK—17 rocket motor.
b. AIM—9J—2/J—3/P—2/P—3 with the SR—116 rocket motor.

When power is applied to the airplane, the CC is initialized with the equations of preceeding case (b) and HUD window 2 shows S4. Placing the NCI DATA SELECT knob to CCC allows the action of the UPDATE button to cycle between the two sets of data. When case (a) is selected, HUD window 2 shows S4J.

ATTITUDE HEADING REFERENCE SET (AHRS)

The AHRS is the primary source of magnetic heading and is the backup source of attitude information to the CC and radar if the INS fails. Refer to Section III, Failure Modes.

LEAD COMPUTING GYRO (LCG)

The LCG provides inputs to the CC for A/A gun reticle control. The LCG provides total lead angle computations for gun tracking if the CC fails.

AVIONICS MODE SELECTION

The aircraft avionics operate in 1 of 4 modes: A/A, A/G, visual identification (VI), and attitude director indicator (ADI). Three master mode buttons determine which mode is selected. The master mode buttons are push ON–OFF buttons placarded A/G, ADI, and VI (figure 1–2). The applicable button illuminates to indicate which master mode is selected.

A/A MODE

All master mode buttons must be OFF to obtain the A/A attack HUD display for the weapon selected on the throttle weapon switch (figure 1–2). Any illuminated master mode button is deselected when GUN is selected on the throttle weapon switch. If the ADI or VI master mode buttons are illuminated, the throttle selected MRM, SRM and gun weapons can be launched/fired; however, the HUD display remains as selected by the master mode button.

A/G MODE

An illuminated A/G master mode button selects the A/G mode, enables the A/G weapon release circuits, selects A/G radar ranging mode, and commands the HUD to display information for the delivery mode selected on the armament control panel (ACP). The MRM and SRM launch circuit is disabled. Refer to TO 1F–15C–34–1–2.

ADI MODE

An illuminated ADI master mode button selects the ADI mode and commands the HUD to display navigation information. The radar, VSD, and A/A weapon circuits are operational in MRM, SRM, or GUN modes. Refer to TO 1F–15C–1.

VI MODE

An illuminated VI master mode button selects the VI mode and commands the HUD and VSD to provide steering that directs the aircraft to a visual identification position on an airborne target (behind, below, and to the right of the target). The GUN, SRM, and MRM weapon launch circuits are operational. Refer to HUD displays and VI steering.

A/A ATTACK MODE SELECTION

THROTTLE WEAPON SWITCH

The three position throttle weapon switch (figure 1–2) selects the A/A HUD display for MRM, SRM and GUN, and enables the MRM or SRM launch circuits if the master arm switch is in ARM.

GUN	Immediately deselects any other master mode and enables the HUD gun steering attack display. This does not enable the gun fire circuits; the gun is hot when the master arm switch is in ARM.

SRM	Commands the HUD and VSD SRM attack display in the A/A master mode, and enables the SRM launch circuits in any master mode except A/G.
MRM	Commands the HUD and VSD MRM attack display in the A/A master mode, and enables the AIM-7 missile launch circuits in any master mode except A/G.

WEAPON RELEASE BUTTON

The weapon release button is hot when the master arm switch is in ARM. Pressing the weapon release button in the ADI, VI, and A/A master modes launches the MRM or SRM weapon and operates the HUD camera.

GUN TRIGGER SWITCH

The first detent of the trigger runs the HUD camera. The second detent fires the gun any time the master arm switch is in ARM.

NOTE

- Launch/fire/release of any weapon, including the gun, is inhibited if the landing gear handle is down. Figure 1-3 is a flow diagram of the minimum switch requirements for weapon employment and jettison.
- L/MSL and R/MSL positions IN and OUT on the SELECT JETT knob are disabled for SRM jettison after TO 11L1-2-14-502.

WEAPON EMPLOYMENT & JETTISON

MINIMUM SWITCH REQUIREMENTS

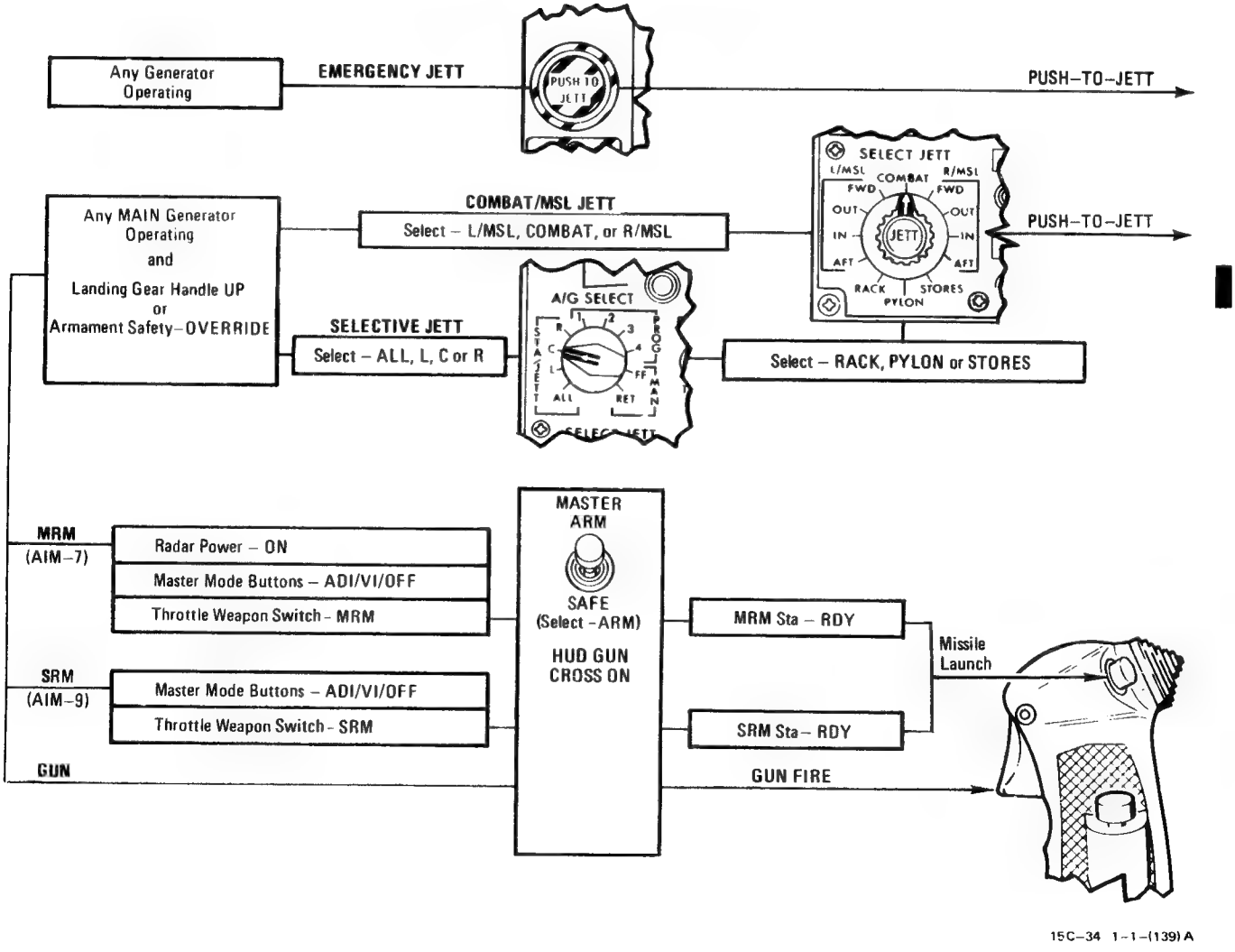

Figure 1-3

RADAR SET

The radar set is a high frequency, pulse doppler attack radar designed primarily for air-to-air combat. The radar provides target range, range rate, antenna angles and angular rates to the central computer for the computation of the selected weapon attack mode parameters. Radar video is synthetically produced on the VSD by digital means; a target is displayed in symbol form. The B-scan format, which is a range (or velocity) versus azimuth scan format, is used for the air-to-air modes. Radar mode controls are provided on a single panel on the left console. Additional operating controls are on the throttles and control stick grip.

The radar set consists of several line replaceable units (LRU) and connecting waveguide assemblies. Most of the equipment is mounted in the forward left equipment bay (figure 1-4).

The main antenna receives high power rf energy from the transmitter and radiates a narrow beam for target illumination. Radar returns are processed and routed to the receiver for target detection, tracking, and display. During all modes except the beacon mode, the radiated beam from the antenna is vertically polarized. When the beacon mode is selected, the antenna roll gimbal is rotated 90° to provide the horizontal polarization required for beacon operation.

The antenna also contains the null-filling horn and guard horn. The null-filling horn is a small aperture antenna mounted on the upper perimeter of the main antenna. This horn provides wide angle coverage using vertical polarization. A portion of rf energy is transmitted from the null horn during MRM missile launch to fill in the null region of the main antenna pattern. The output of both the main antenna and the null horn is the primary and optimum source of high PRF radiation for MRM missile illumination and guidance. A backup source of missile illumination is provided through the flood antenna. (Refer to Flood Mode in later paragraphs). The guard horn is a small antenna mounted on the lower perimeter of the main antenna that provides wide angle reception of rf side lobe energy. This signal is compared to that of the main receiver signal for the purpose of reducing false alarm rates.

RADAR MODIFICATIONS

After TO 1F-15-606, the radar target data processor (041 unit) is replaced with a programmable signal processor (PSP). Also, the main memory capacity of the radar data processor (081 unit) is expanded from 24K to 98K words. The modification provides the capability to rapidly implement future system modifications through software change only. The following capabilities are to be available in PSP aircraft:

a. A high-resolution Raid Assessment Mode (RAM) with associated VSD display symbology. (After TO 1F-15-595).
b. A selectable Ground Moving Target Inhibit Mode (GMTI).
c. An azimuth stabilized display.
d. An ECCM feature providing improved immunity to HI PRF velocity gate stealer activity.
e. A high-resolution, expanded MAP DBS (doppler beam sharpening) mode is added after TO 1F-15-737 and is updated by TO 1F-15-595. (Refer to TO 1F-15C-34-1-2).
f. The PULSE radar mode transmits in MED PRF.

Reference to these aircraft is made by the respective TO number or by the notation, "PSP aircraft."

RADAR SEARCH MODES

LONG RANGE SEARCH (LRS)

The long range search (LRS) pulse doppler mode is the primary air-to-air surveillance mode. In LRS, the radar operates in both high (HI) and medium (MED) pulse repetition frequencies (PRF). The PRF is interleaved with each bar scan. For example, the first bar is HI PRF; the second is MED PRF; the third is HI PRF, etc. However, if the 10 NM range is selected, only MED PRF is employed. Selection of 160 NM search range provides all HI PRF.

The radar detection range performance is highly sensitive to the target cross sectional area (measure of target reflectivity), target doppler conditions (component of the target ground speed along the radar line of sight), ground clutter signal strength (ground reflection coefficient), and tactical conditions (look-down versus look-up). The dual PRF in the LRS mode maximizes the potential for target detection under all of the above conditions for both tail aspect targets and nose aspect targets, either above or below the F-15. The HI PRF waveform provides long range detection performance only against nose aspect targets in either look-up or look-down conditions. The MED PRF detection performance is optimized for both nose or tail aspect targets, either during look-up or look-down conditions. However, the MED PRF detection range performance (both nose and tail aspect) is considerably less than that of the HI PRF detection range performance against nose aspect targets. These facts should be kept in mind during situations where changing conditions are occurring in target aspect angle. The details of detection performance are discussed further in TO 1F-15C-34-1-1-1. The radar display is in terms of

RADAR SET INSTALLATION

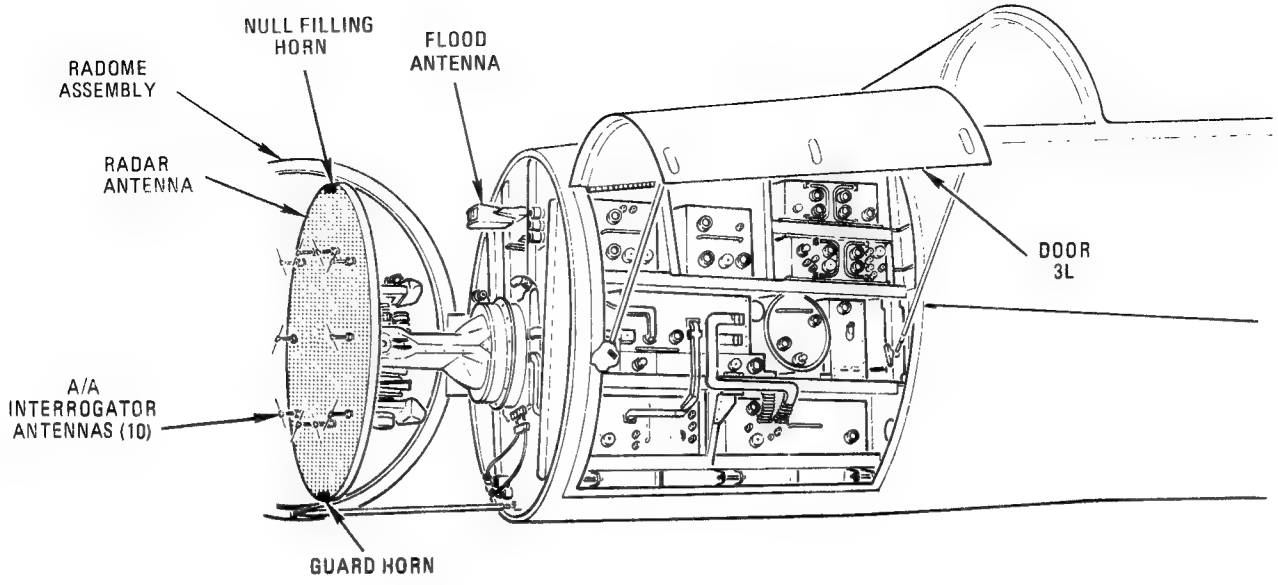

Figure 1-4

range versus azimuth. Figure 1-5 shows a 6-bar scan pattern selected and how the PRF are interleaved on a frame-to-frame basis. (Refer to Radar Controls, Frame Store Knob.)

VELOCITY SEARCH (VS)

The velocity search (VS) mode is a pulse doppler, long range surveillance mode in which the search display is presented in terms of target relative ground speed versus azimuth. Target relative ground speed is that component of the target ground speed in your direction. The VS mode utilizes the HI PRF waveform exclusively and is slightly more sensitive in terms of target detection performance than the HI PRF LRS mode; the initial target detections could be slightly greater for the same tactical conditions. Range information however is not presented on the VSD during the VS search mode. Nose aspect targets with closing ground speeds of at least 80 to approximately 1800 knots are displayed. The VS mode provides a 300 knot upward shift in velocity coverage when the 160 mile range is selected. Only nose aspect targets with closing ground speeds of 380 to 2100 knots are displayed. Targets with aspect angles and/or speeds outside of these relative limits are not displayed.

LRS and VS Doppler Mode

In LRS or VS mode, the radar periodically enters a doppler mode to update the velocity data used by the radar. The mode is automatic and occurs approximately every 7 minutes. The antenna is driven down 15° and alternately 45° left and right in azimuth. The doppler derived ground speeds are used to correctly position the main lobe clutter filters which aid in obtaining a clutter free display. The update does not affect ground speed or INS present position data. During the 3-second update period, the LRS/VS display is frozen and the antenna azimuth and elevation carets are positioned at zero degrees. The normal search display is resumed after a single velocity update is completed or after 3 seconds.

SHORT RANGE SEARCH (SRS)

The short range search (SRS) pulse doppler mode is optimized for a short range, high-maneuvering air-to-air attack using primarily the SRM or gun weapons. MED PRF is used to provide the required short range capability for low altitude, clutter environment attacks.

PULSE MODE

Before PSP, the PULSE mode is a low (LO) PRF (nondoppler) mode provided as a back-up search and track capability, especially designed for nonclutter (look-up)

LONG RANGE SEARCH

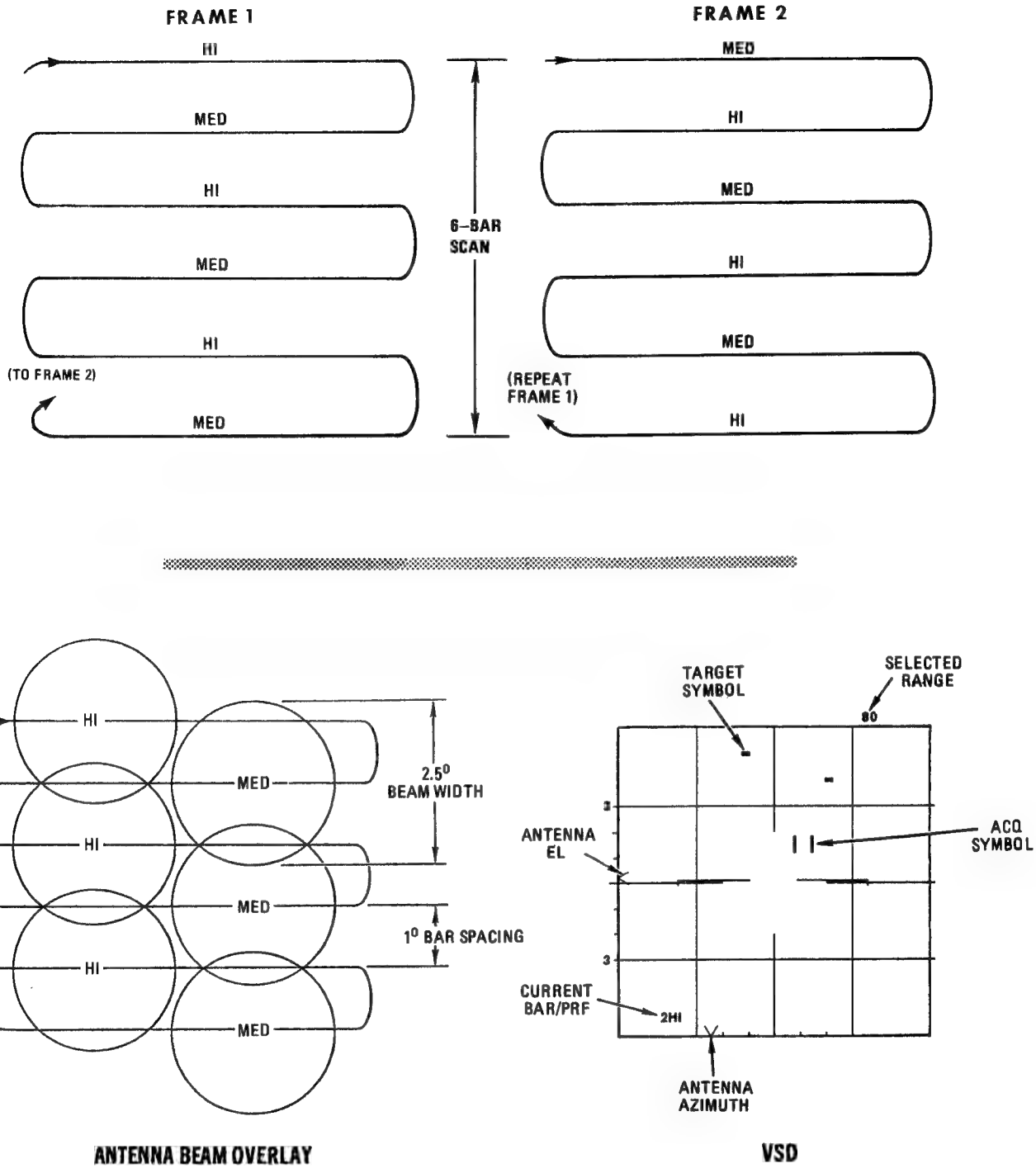

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Figure 1-5

A/A MODES
RADAR SEARCH PARAMETERS

A/A MODE	RANGE/VELOCITY SCALES SELECTABLE	ANTENNA SCAN (SEARCH)		VSD DISPLAY
		AZ SCAN	EL BARS	
Long Range Search (LRS) HI/MED PRF (1)	10, 20, 40, 80, or 160 NM	120°, 60° or 20°	1, 2, 4, 6 or 8 Bars	(4) B-Scan, Space-Stabilized Up to 7 Frame Data Aging
Velocity Search (VS) HI PRF	Search: RNG Scale, 80 to 1800 kts TGT Relative GS (2) Track: 10, 20, 40, 80, or 160 NM	Same as LRS		Same as LRS except during search, TGT Relative GS Instead of RNG
Short Range Search (SRS) MED PRF	Search: 10, 20, 40, NM Track: 10, 20, 40, 80 or 160 NM	Same as LRS		Same as LRS
Pulse Search LO PRF (3)	10, 20, 40, 80 or 160 NM	Same as LRS		(5) B-Scan, Space-Stabilized No Data Aging
Beacon LO PRF	10, 20, 40, 80 or 160 NM	Same as LRS		B-Scan, Space Stabilized
RAM MED PRF	5 NM to 35 NM Scan Center	(see below)		B-Scan, Space Stabilized Automatic Data Aging

(1) MED PRF only in 10 NM range: HI PRF only in 160 NM range.
(2) Velocity coverage in 380 to 2100 KTS in 160 NM range.
(3) In PSP aircraft, becomes MED PRF mode.
(4) In PSP aircraft, only 3-Frame data aging available.
(5) In PSP aircraft, same as LRS.

RAM SCAN PATTERNS

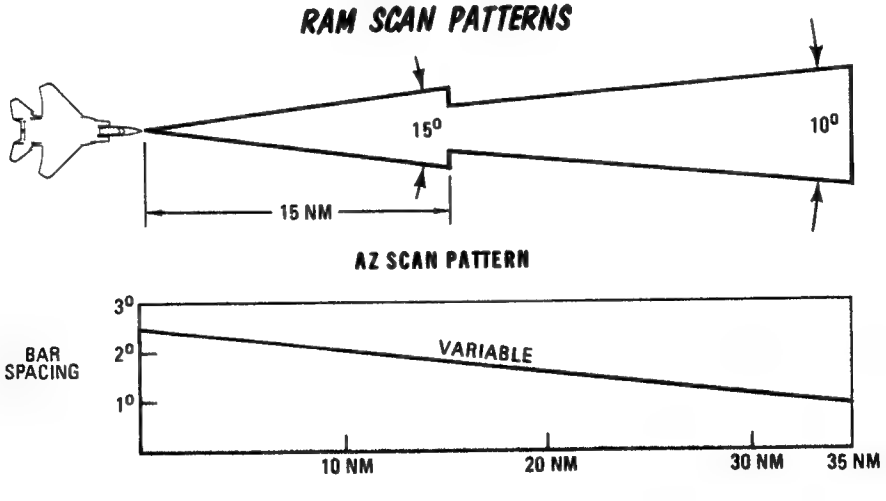

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Figure 1-6

conditions with no capability in look-down conditions. Clutter rejection is not available in this mode; therefore, the target competes with clutter during look-down situations and the pilot faces the difficult task of separating the airborne and ground returns on the display. Targets are displayed as individual lines, and the intensity varies with target size and range.

In PSP aircraft, the PULSE mode is changed to a MED PRF mode which improves detection performance in the look-up environment. The mode operates the same as SRS during look-down conditions; clutter rejection is active. In look-up conditions, clutter rejection is not active. and therefore the mode has better detection performance (than SRS) because of a reduction in radar blind zones.

BEACON MODE

In BCN (LO PRF) mode, the radar interrogates an airborne beacon transponder. The beacon reply is displayed on the VSD as a coded target return. The display appears as short dashes and the number of dashes indicates the code. The first dash is the correct range to the beacon. There is no lockon capability in the BCN mode. The acquisition symbols are displayed on the VSD for altitude coverage information. (Refer to VSD Symbols, Altitude Coverage). The F-15 associated transponder equipment for A/A operations is the APN-69 set.

RADAR SEARCH PARAMETERS

The radar mode operating parameters (range, AZ/EL Scan) that the pilot may manually select for the air-to-air search modes are shown in figure 1-6. The RAM scan parameters, which are automatically established when the mode is commanded, are also shown. (Refer to Raid Assessment mode, latar paragraphs.) The search mode parameters automatically commanded in radar AUTO mode operations (including auto range scale switching) are also described in later paragraphs. Refer to Radar Controls, MODE CONTR switch.

ACQUISITION MODES

MANUAL ACQUISITION

Manual acquisition is accomplished by using the throttle target designator control (TDC) and observing the VSD acquisition symbol. The pilot brackets the target with the acquisition symbol by applying force in the proper direction on the TDC as shown in figure 1-7. Pressing the TDC (action position) commands the radar to enter a $\pm 3°$ azimuth acquisition scan (mini-raster) centered on the acquisition symbol in azimuth, and searching the selected EL bar pattern in elevation. Releasing the TDC commands radar lockon. The radar simultaneously attempts to correlate any stored target hits with the acquisition symbol position for a maximum period of 5 seconds. When correlation occurs, the radar automatically selects the PRF and bar scan which was in use at the time of detection of the stored target for a period of 1.5 seconds maximum (figure 1-7). Lockon is accomplished on the second live target hit received within the acquisition symbol. If lockon is not achieved within 1.5 seconds, the scan changes automatically to the number of EL scan bars selected and to the appropriate PRF interlace. If lockon is still not achieved, the radar remains in the acquisition scan with the lockon command active. The pilot has the choice of adjusting the position of the antenna acquisition scan by using the TDC control for azimuth positioning and the EL control on the throttle for elevation positioning to spot-light the target; or return the radar to the selected search mode by momentarily pressing the auto acquisition switch to REJECT.

Acquisition and lockon in the VS mode is accomplished in the same manner as described above. After lockon in the VS mode, range information may or may not be presented depending upon the target signal strength or whether the target range exceeds the maximum radar range processing capabilities. If this is the case, range will be presented when the target closes sufficiently to overcome the limitations.

When lockon is established, the VSD track display appears and the lock/shoot lights come ON steady. Refer to Lock/Shoot Lights, Radar Controls.

AUTOMATIC ACQUISITION

There are four auto acquisition modes: supersearch, boresight, vertical scan, and auto gun scan. Both the SS and BST modes are selected through the forward position of the auto acquisition switch; the first actuation selects SS, the second actuation (while the radar is still in search) selects BST. The rear position of the switch selects vertical scan. The gun auto scan mode is in operation when GUN is selected on the throttle weapon switch and the radar is in the AUTO mode. If the radar is tracking, all auto acquisition modes are inhibited unless REJECT is selected. The search range display obtained in all auto acquisition modes is 10 miles.

Supersearch Mode

In supersearch, the radar automatically scans the HUD FOV (20° X 20°) in a MED PRF, 6-bar scan pattern until track is established or auto acquisition REJECT is selected. The bar spacing is 3.4° and the scan begins at the top of the HUD FOV. Lockon occurs automatically and the radar tracks (in range and angle) the first target detected within this scan pattern. The auto acquisition selections are disabled when track is established. The pilot must press REJECT to return to the selected search mode or to reselect any auto acquisition mode.

When supersearch is first selected, the HUD display shows the 20° reference circle. When angle track occurs, the track display of the selected weapon appears and the target designator shows the space position of the target being tracked. Refer to Part 2, Radar Employment, for additional auto acquisition considerations.

Before PSP, the scan pattern always begins at the top of the HUD FOV with each bar scanning parallel to the aircraft wings.

After TO 1F-15-737, special mode logic and varying scan patterns are used to enhance lockon capability (figure 1-7A). During the first 40 seconds after take-off, the bar

MANUAL ACQUISITION

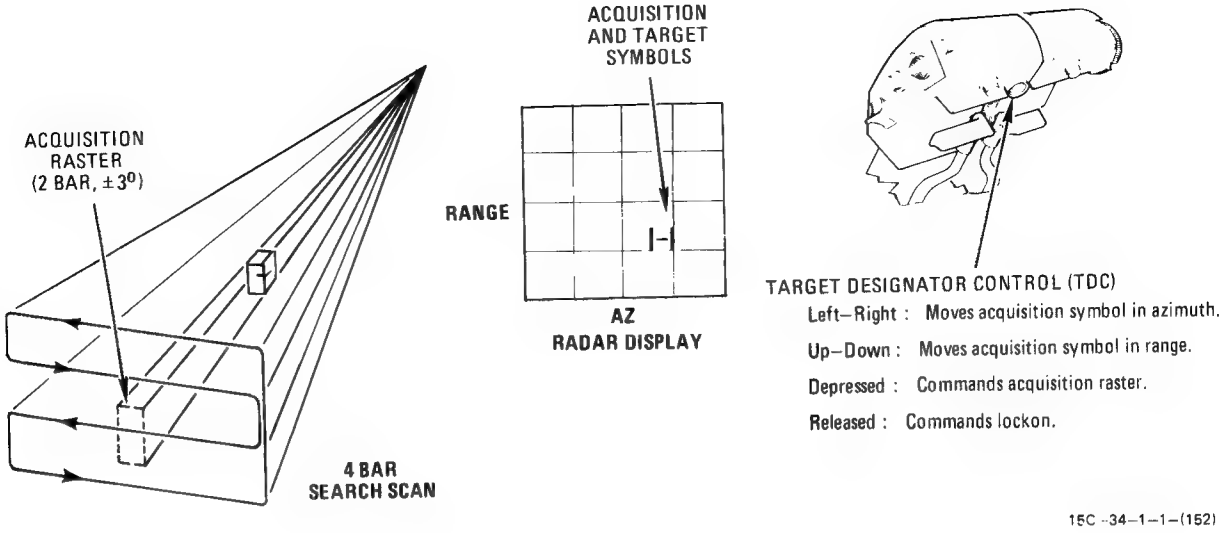


Figure 1–7

scan pattern remains parallel to the aircraft wings with scan pattern beginning at the top of the HUD FOV. Special detection threshold logic is used to avoid false lockon to the ground. During all other times and for roll angles less 45°, the bar scan pattern remains parallel to the wings, however the scan pattern begins at the bottom of the HUD FOV (display 2, figure 1–5A). For roll angles greater than 45°, the bar scan pattern is perpendicular to the aircraft wings with the scan pattern beginning at the left side of the HUD FOV (display 3). The scan pattern variations enhance lockon capability during F–15 and/or target maneuvering conditions.

Boresight Mode

The boresight (BST) mode is an auto acquisition mode for targets located along the aircraft boresight line. The antenna slaves to the boresight position and the radar continually searches in range from 500 feet to 10 NM along the antenna line–of–sight until a target is acquired or until REJECT is selected. The radar transmits in MED PRF or (before PSP) LO PRF if PULSE is selected. The pilot maneuvers to place the target within a 4° BST steering circle on the HUD. When lockon occurs, the radar begins automatic tracking and the attack steering presented on the HUD is a function of the A/A weapon selected. The pilot must select REJECT to return to the selected search mode or to reselect any auto acquisition mode.

Vertical Scan Mode

In vertical scan auto acquisition, the radar antenna scans vertically, 40° in elevation starting at 5° above fuselage reference line (FRL), and 7.5° in azimuth using a 2–bar azimuth scan (figure 1–8). The radar transmits in MED PRF with lockon capability from 500 feet to 10 miles in range. The scan is aircraft stabilized, and continues until lockon or until REJECT is selected.

Auto Gun Scan Mode

The auto gun scan (MED PRF) mode (figure 1–8) provides a positionable scan pattern with the automatic acquisition capability between 0.5 and 10 miles. The scan pattern is 60° in azimuth, 20° in elevation, and is space stabilized. The center of the pattern, indicated by the VSD acquisition symbol, can be positioned in AZ and EL using the throttle TDC. The VSD altitude coverage display is based on a fixed 5 mile range. The scan center is positioned at 0° AZ and EL when the mode is initialized or when the auto acquisition REJECT is selected during the scan. The BST, SS, or vertical scan modes may be selected during the gun scan.

After lockon, the HUD gun attack steering display is provided and the VSD windows display target track data (speed, Gs, and aspect angle). Selecting auto acquisition REJECT will break lock, position the scan center 5° right and 1.7° down from the original acquired target, and resume the auto scan (bump acquisition) until another target is acquired.

RAID ASSESSMENT MODE (RAM)

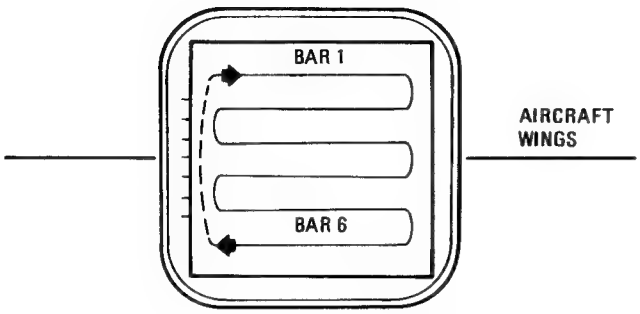
(PSP Aircraft, After TO 1F–15–595)

The RAM mode enables the pilot to assess a suspected multitarget environment. RAM is a MED PRF mode and may be entered from radar track provided the target range is less than 40 miles. The mode is entered by momentarily selecting the auto acquisition switch forward position.

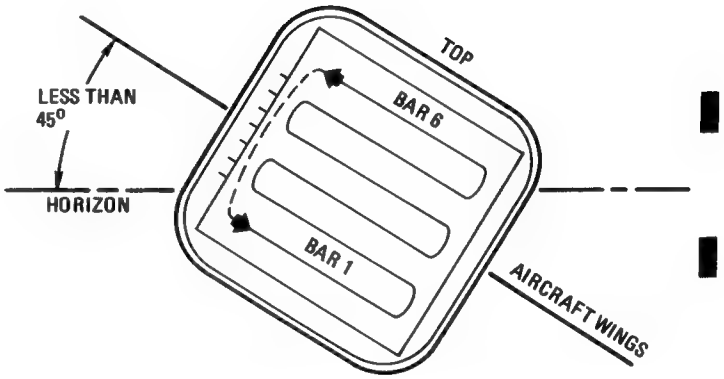
When RAM is entered, the radar attempts to form track files on up to three targets in addition to the original tracked target (the designated target). In RAM, the radar alternates between a scan phase and a spotlight phase. In the scan phase, the radar scans a small sector (±5 miles in range) around the designated target. A slower antenna azimuth sweep rate is used compared to normal MED PRF search modes. This allows special signal processing which

SUPER SEARCH SCAN PATTERNS

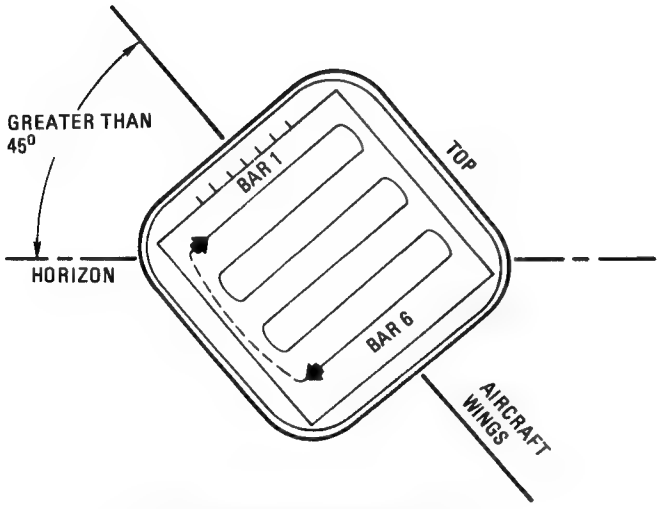
(AFTER TO 1F-15-737)



1. FIRST 40 SECONDS AFTER TAKEOFF, ALL ROLL ANGLES



2. MORE THAN 40 SECONDS AFTER TAKEOFF, ROLL ANGLES LESS THAN 45°

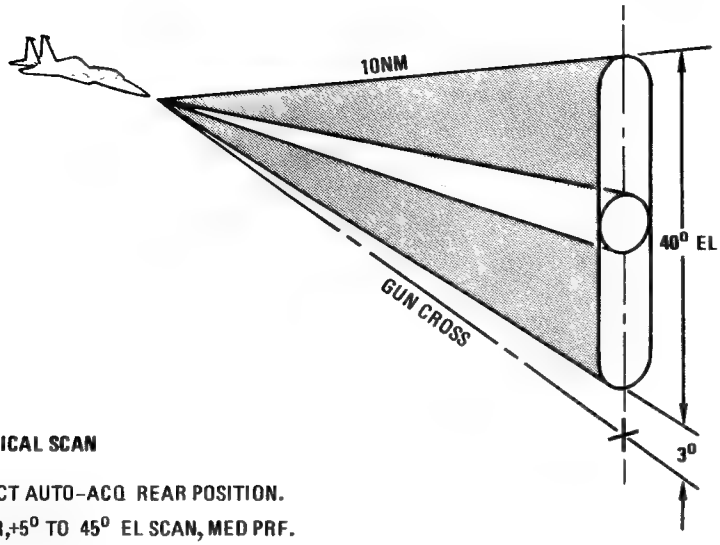


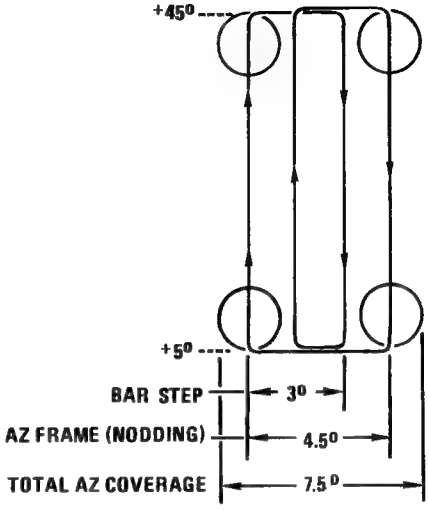
3. MORE THAN 40 SECONDS AFTER TAKEOFF, ROLL ANGLES GREATER THAN 45°

15C-34-1-1-(172) A

Figure 1-5A

VERTICAL SCAN/GUN SCAN AUTO ACQUISITION



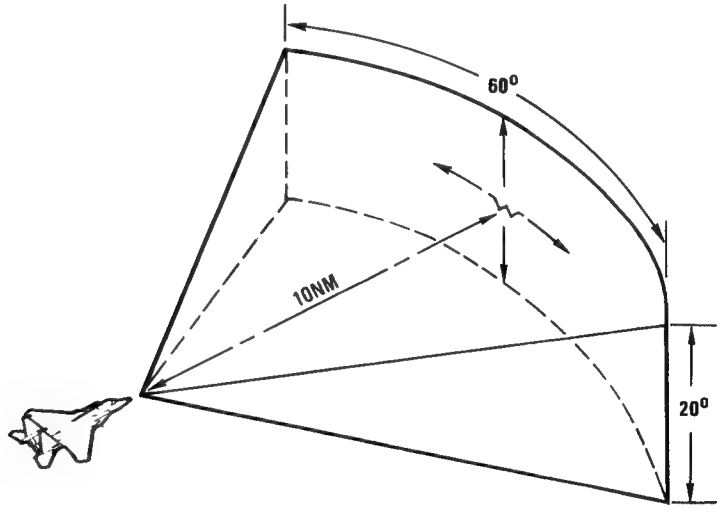


VERTICAL SCAN

- SELECT AUTO-ACQ REAR POSITION.
- 2 BAR,+5° TO 45° EL SCAN, MED PRF.
- AUTO-ACQ FROM 500 FEET TO 10 NM.

AUTO GUN SCAN

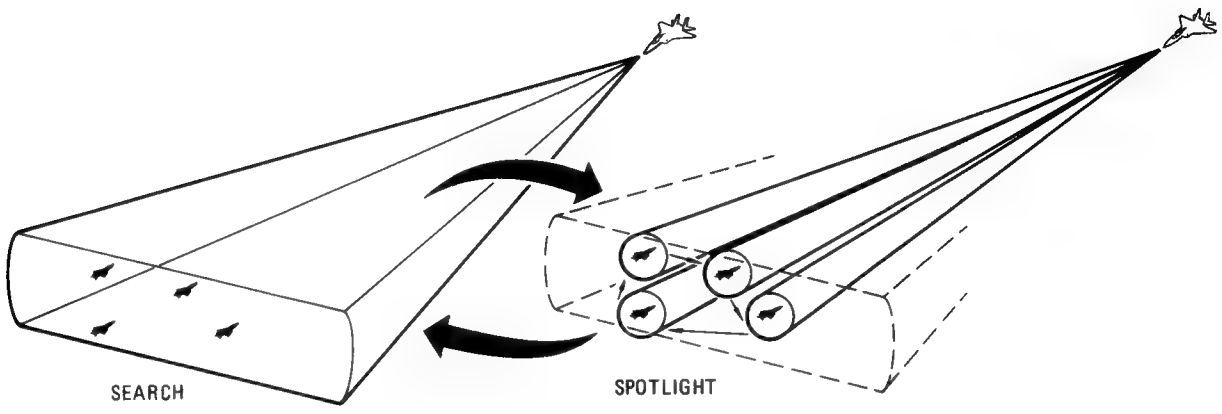
- SELECT GUN/AUTO MODE.
- 6 BAR, 20° EL/60° AZ SCAN, MED PRF.
- SCAN CENTER AZ/EL CONTROLLED BY TDC.
- AUTO-ACQ FROM 0.5 TO 10 NM.
- BUMP AUTO-ACQ BY SELECTING REJECT.



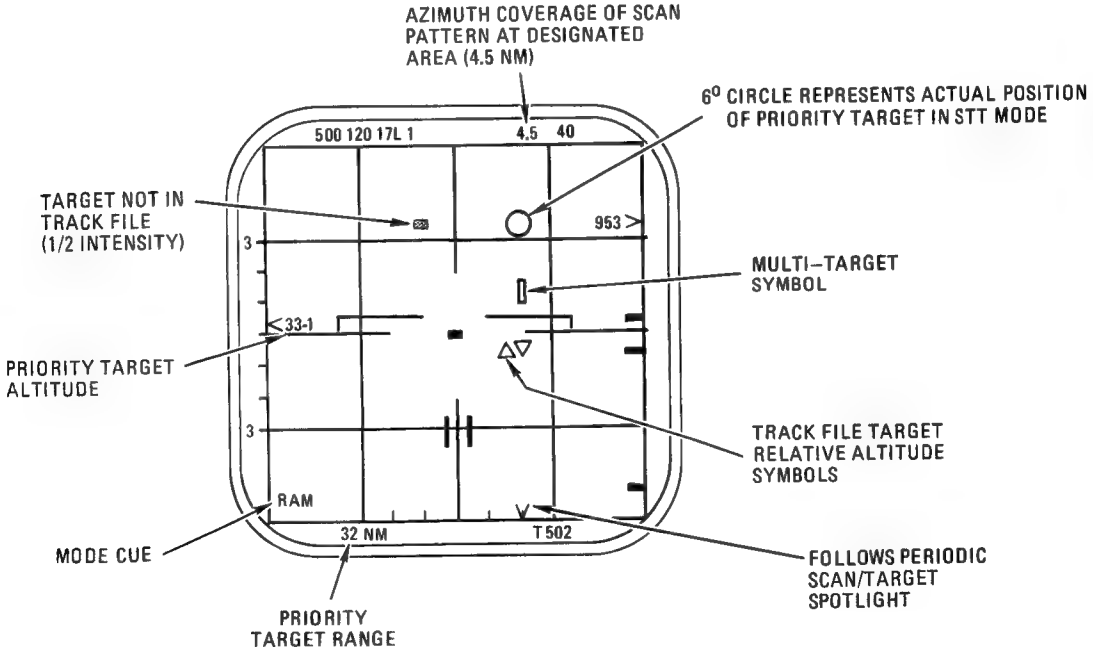
15C-34-1-1-(163)

Figure 1-8

RAID ASSESSMENT MODE



IN RAM, THE RADAR ALTERNATES BETWEEN SEARCH AND SPOTLIGHT



RAM TRACK DISPLAY SYMBOLS

15C-34-1-1-(171)B

Figure 1-8A

provides greater sensitivity and fewer blind zones. The azimuth scan and elevation bar spacing dimensions are shown in figure 1–6. In the spotlight phase, the antenna briefly points at the designated target and up to three additional targets (originally detected in the search phase) in order to establish or update target track file data. Only one bar of the 2 bar search pattern is scanned between spotlight phases. (The upper bar is scanned first, followed by a spotlight phase, and then the lower bar scan.) The bar scan pattern is centered around the designated target elevation. (The throttle elevation control has no effect in RAM.) Once a target is in the track file, however, spotlight attempts are allowed ±15° in elevation with respect to the designated target. More than four targets may be detected and displayed during the scan phase, but only the targets in the track file have their parameters updated during the spotlight phase.

The target display in RAM (figure 1—8A) is B—Scan, range versus azimuth, in an expanded format (±5 miles and ±7.5° in azimuth) referenced to the designated target. The designated target remains at the display center unless range is greater than 35 miles or less than 5 miles, or when near the azimuth gimbal limit (within 7.5°). Peripheral display information such as the azimuth caret, range caret, and missile launch cues (Rmax/Rmin) are displayed with respect to the normal range and ±60° azimuth format.

The expanded display format centered about the designated target can create a misconception in the appearance of targets on the display. Target separation changes in azimuth due to range closure can be misinterpreted as maneuvering. Changes in target formation can appear to occur as the result of range and look angle changes to the designated target. Designated target maneuvering may be misinterpreted as secondary target maneuvers. To aid situation awareness while in the expanded target display format, a 6° designated target reference circle is located at the position the target would appear on the STT display. The circle flashes when the designated target azimuth or elevation angle exceeds 50°.

Targets detected in the scan phase are displayed as half-intensity radar target symbols. Those which successfully enter the track file during the spotlight phase are displayed as full-intensity symbols like the designated target. When a radar return is not received during a spotlight update on a track file target (other than the designated target), that target is immediately dropped from the track file. Subsequent scan detections on that target may again establish its track file status. The designated target symbol flashes (and the MEM cue is displayed) when an update is not obtained during a spotlight attempt. If three additional spotlight attempts fail, then a return to STT is attempted. If unsuccessful, the radar returns to search. Any track file symbol may change to a multitarget symbol if, during spotlight, the radar determines that any additional target is located near the track file target.

The pilot may designate any other target appearing on the RAM track display using the normal TDC/action switch procedure. The redesignation occurs immediately if that target is another track file target. If not a track file target (half-intensity symbol), then the redesignation will not complete until a successful spotlight phase occurs and the target enters the track file. (Target track parameters do not appear during the redesignation process until the spotlight phase has established stable track file data.) If this does not occur within 5 seconds, the redesignation attempt is aborted. If four targets already existed in the track file when a nontrack file target is designated, then one of the secondary track file targets is removed.

STT is re–entered from RAM track by momentarily positioning the auto acquisition switch forward. The designated target on the RAM track display then becomes the tracked target in STT. (Refer to TO 1F–15C–34–1–1–1 for additional information on RAM mode performance.)

RAM Relative Altitude Display

When RAM track is in progress, the pilot can command the relative altitude display to determine the altitude relationship between the priority target and the remaining track file targets. Momentarily selecting the auto acquisition switch rear (vertical scan) position initiates the display and the RAM cue changes to RAM–A. Any track file target changes to an upward triangle symbol (figure 1–8A) if its altitude is more than 1000 feet higher, or more than 1000 feet lower (inverted triangle) than the designated target. Momentarily selecting the rear position again causes any relative altitude symbol to revert to the normal target symbol. When the radar is in the process of establishing a new track file (for any reason), operating in the relative altitude mode can cause an erroneous triangle display due to an initial inaccurate target altitude assessment.

RAM Inhibit

Ram entry is inhibited (NO RAM is displayed in the VSD BIT window) by any of the following conditions when RAM is commanded.

a. The tracked target is beyond 40 NM when RAM is commanded.
b. An AIM–7 launch is in progress and/or missile is in flight when RAM is commanded.
c. The radar is in BIT track test when RAM is commanded.
d. RAM may be inhibited when commanded within a few seconds after lockon or when the radar internal parameters indicate an unstable track.

RADAR SPECIAL MODES

The special modes are selected on the radar control panel special (SPL) MODE knob. The MAN TRK (manual track, before PSP) and FLOOD special modes are backup operating modes that may be used if lockon cannot be accomplished or maintained in the normal A/A radar modes. The SNIFF mode is a receive–only (STBY) mode. The modes provide a weapon delivery capability when radar operations are degraded; i.e., when ECCM techniques are necessary.

MANUAL TRACK

Before PSP, the MAN TRK mode is used when target tracking is inhibited due to problems in the radar tracking system. In MAN TRK, the antenna is automatically operated in a 2-bar, ±3° AZ scan pattern. The pilot continually tracks the target using the target designator control (TDC) to position and maintain the acquisition symbol over the target return, and uses the antenna elevation control to maintain target illumination by the radar beam. The pilot is manually positioning the range gate and antenna so that range and angle data is available for the CC. Using this range and antenna angle data (zero angular rates), the CC can compute the command steering display for both the VSD and the HUD. At any time in the manual track sequence, the pilot may depress and release the TDC and attempt to get automatic track. This causes the radar to exit the MAN TRK mode and enter the normal target acquisition sequence. If the AIM-7 is launched in this mode, the flood antenna is automatically energized. (See Flood Mode Automatic Selection in following paragraphs.)

After PSP, the MAN TRK mode is deleted. Refer to TO 1F-15C-34-1-1-1.

SNIFF MODE

The SNIFF is a passive/active mode used to detect jamming of the radar channels or to provide a minimum radar radiation time to prevent detection. When SNIFF is selected, the radar ceases to transmit at the end of the current bar and continues to receive in the PULSE (before PSP) and scan in a single bar without radiating. (After PSP, the radar continues to receive in the PRF selected: HI, MED, or interleaved.) Targets that are jamming the radar are received as the antenna sweeps past their position. These targets are displayed in a B-scan display unless MAP (PPI scan) is selected.

Temporary active transmissions may be initiated by pressing auto acquisition REJECT. This commands the radar to transmit for one complete azimuth sweep (two in LRS) and then return to a non-transmitting or passive state. All target returns resulting from the transmitted sweep are displayed. The returns are retained without aging or erasing until REJECT is released, erasing all target returns from the display at the end of the bar. This process may be repeated as required.

The pilot may attempt a manual acquisition in the normal manner by pressing and releasing the TDC. This causes the radar to exit the SNIFF mode and enter the normal target acquisition sequence. If the lockon attempt fails, the radar returns to the SNIFF mode. (Refer to Radar Employment, ECCM Modes, TO 1F-15C-34-1-1-1.)

FLOOD MODE, MANUAL SELECTION

Manually selecting the FLOOD mode immediately energizes the flood antenna output (figure 1-9). The main antenna is driven to a 60° look-down angle. The forward position of the auto acquisition switch enables radar automatic range acquisition from minimum range to 2 nautical miles. This is an in-close, visual, dog fight mode which can be manually selected as a back-up mode if lockon by the preferred modes cannot be obtained. For the gun attack, the mode provides lead compute reticle steering by obtaining range data from the nearest target within the 2 NM limit and within the flood antenna beam width. The radar operates in medium PRF unless PULSE mode (LO PRF) has been selected in aircraft before PSP. The PULSE mode is expected to provide the most rapid lockon time. After PSP, the radar always operates in MED PRF during FLOOD mode.

FLOOD MODE, AUTOMATIC SELECTION

During MRM launch operations, the radar automatically commands the operation of the flood antenna in the following situations. (Refer to TO 1F-15C-34-1-1-1 for additional information.)

a. The radar is not in HI PRF track. (This excludes the first 1.5 seconds after a HI PRF lockon and the 0.5 second after a MED to HI PRF track transfer).
b. During search, acquisition, or RAM operations.
c. During BCN, SNIFF or MAN TRK (before PSP) modes.
d. During LO or MED PRF track, or LO or MED PRF TRK MEM operations.
e. During TK MEM operations with HI PRF, if the target is within flood antenna beam width and range.

Flood illumination is effective to approximately 8 miles, depending on target size. On the HUD, the FLOOD cue appears and the MRM 12° reference circle is displayed. The pilot steers to keep the target within the circle.

When FLOOD is automatically activated in MRM operation, the selection of any automatic acquisition mode (except AUTO GUN scan) or REJECT will return radar to normal search.

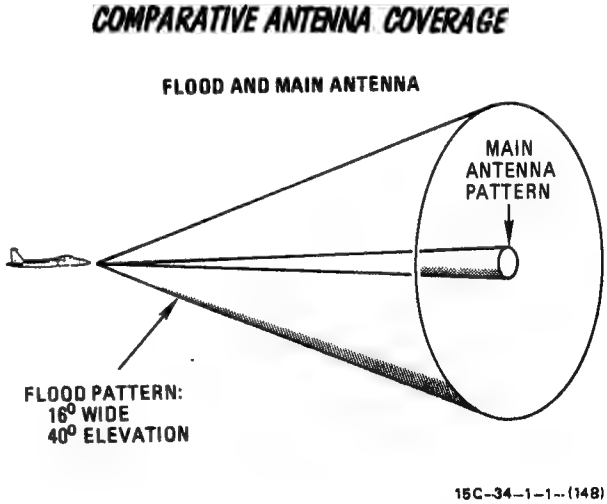


Figure 1-9

All data on pages 1—12C thru 1—12D deleted.

RADAR SET CONTROLS

The application of radar system power and the manual selection of radar operating parameters is provided through the radar set control (RSC) panel (figure 1-10).

RADAR POWER KNOB (MRM TUNING)

For additional power knob functions, refer to Radar BIT System, this part.

OFF — The radar set is completely deenergized.

STBY — All radar functions are operational except transmitter high voltage and RF transmission circuits. STBY is displayed in VSD window 1 as long as the standby status is maintained. If STBY is bypassed by going directly to OPR, the standby status is automatically maintained for 3 minutes.

OPR — The radar is in full operation unless the aircraft is on the ground with the weight-on-wheels (WOW) interlock applied. The radar applies an RF illumination signal to each MRM for initial tuning. The TUNE cue appears in VSD window 1 until all missiles tune or for 2 minutes, whichever occurs first.

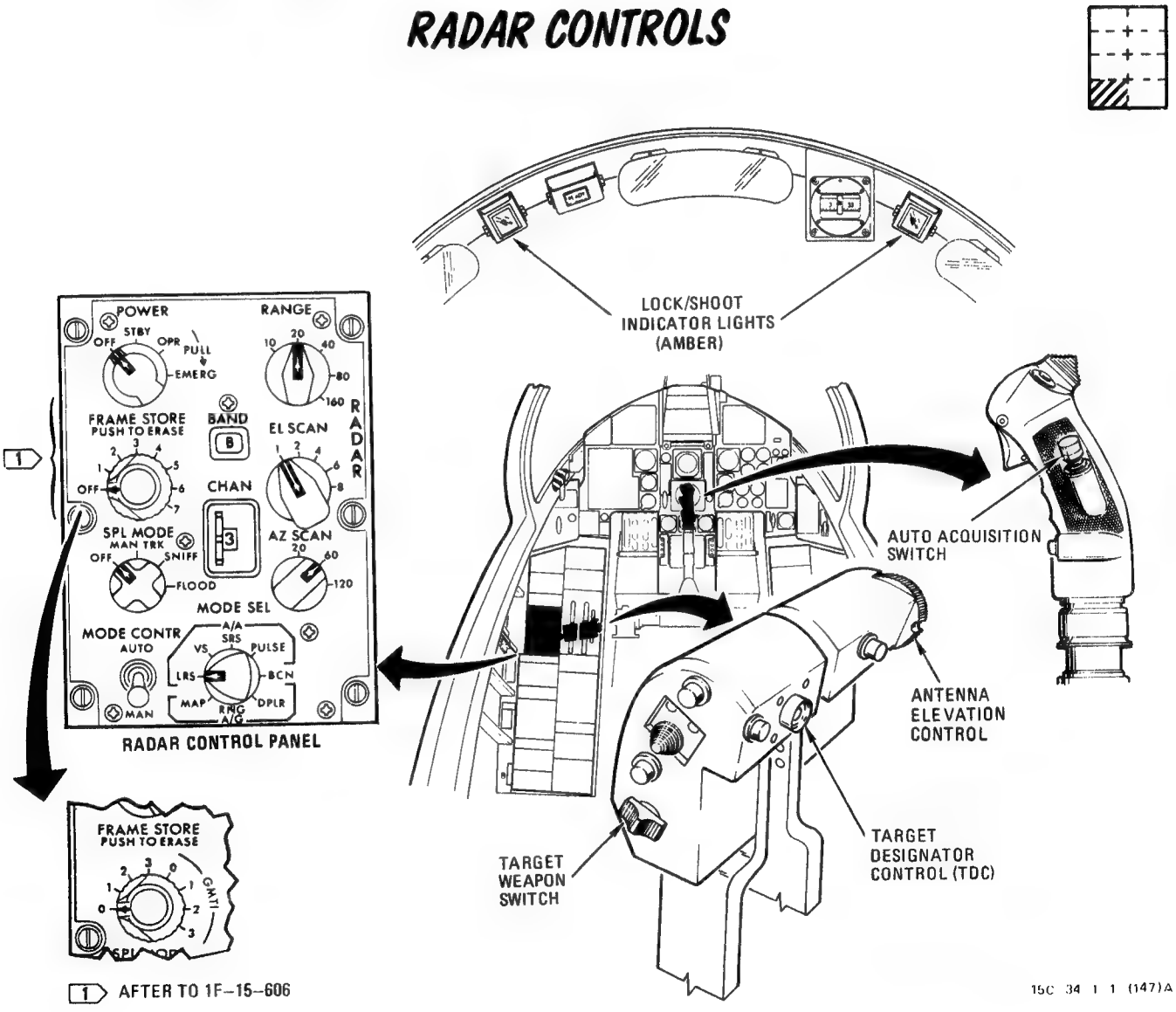


Figure 1-10

EMERG	Commands full radar operation; bypasses radar protective interlocks except the WOW interlock and the transmitter coolant flow. The power knob must be pulled out to select the EMERG position.

Heat and flow sensors are installed to monitor cooling air supplied to the radar data processor. If low cooling is detected, a RDR HOT indication is continuously flashed in the VSD BIT window. If the aircraft is on the ground, the radar is immediately shut OFF (within 10 $\pm$4 seconds) when the overheat condition is detected. In addition to the VSD overheat indication:

a. A radar overheat indication is set in the BIT matrix.
b. The RDR failure light on the BIT control panel comes ON.
c. The radar LRU NO GO indicator on the avionics status panel is set.
d The RDR overheat indicator on the data processor is set.

After automatic radar shutdown (on the ground), the overheat logic may be reset by cycling the radar power knob to OFF and back to STBY or OPR. This procedure may be used to check if the malfunction was only a momentary occurrence. During flight the RDR HOT indication will continue to flash until the radar is turned OFF

CAUTION

The radar should be turned OFF when the RDR HOT indication is displayed. Continued operation of the radar could cause radar damage.

RANGE KNOB

The range knob provides a manual means of selecting the display range scale; either 10, 20, 40, 80 or 160 NM ranges are available. In the velocity search mode, the computation of radar beam altitude coverage is based on the range scale setting and the position of the acquisition symbol on the VSD.

FREQUENCY BAND/CHANNEL SELECT

The frequency band display window indicates which one of three frequency bands (A, B, or C) has been preset into the radar. The radar may be set for any one of the three bands by the replacement of an LRU module in the radar compartment. The channel select thumbwheel may be positioned on any one of six frequencies in that band. This feature may be used to avoid interference between operating radars in the same mission locale, and to provide ECCM in a jamming environment. The channel select thumbwheel may also be positioned to A (automatic) position. In this position, the radar computer randomly selects the operating channel on a bar-to-bar basis in an ECM environment. At the end of each EL bar scan, a different channel is selected if the present one is susceptible to the jamming source. If no ECM environment exists, the last selected channel is used.

AZ-EL SCAN KNOBS

The elevation (EL) scan knob provides manual selection of 1, 2, 4, 6, or 8-bar elevation scan patterns. The azimuth (AZ) scan knob provides manual selection of 20°, 60°, or 120° azimuth antenna scan pattern.

FRAME STORE KNOB
(Before PSP)

The frame store knob provides manual selection of the length of time target data is displayed on the VSD. A single frame is equal (in time) to the current bar scan selection. For example, with a 4-bar scan selected, one frame equals a complete 4-bar scan. The use of multiple frame data aging is most applicable in the LRS or VS radar modes. It is available for the SRS mode and has no operation in PULSE mode.

OFF	Target data is displayed only on the current bar.
1 thru 7	Selects the number of frames for which time history target information is displayed. The target return in the current frame appears at maximum brightness. The stored target from previous frames is also displayed at reduced intensity, which shows the range/azimuth position of the target a (selected) number of frames ago.
ERASE	Pressing the frame store button immediately erases the radar display and erases targets stored in radar memory.

Within the seven frame memory, the bar in which the target appears is maximum brightness, the next two frames are half-brightness, and the remaining frames are at quarter-brightness. A change in the number of elevation bars can have an affect on the stored targets being displayed. For example, if one target is recorded on bar 3 and a second target is recorded on bar 8 of the 8-bar antenna scan pattern, changing the antenna scan pattern to a 4-bar scan results in only the first target (on bar 3) being displayed.

In before or after PSP aircraft, if frame store OFF is selected during an AAI interrogation, the frame setting automatically changes to FS 1 to enable longer retention of the AAI target correlated symbol. (Refer to AAI set, part 5.)

FRAME STORE KNOB
(After PSP)

After PSP, the positions of the frame store knob accomplish the same data aging functions stated in the previous paragraph, except that the maximum selectable frame storage is 3 frames. The zero position(s) of the knob

is the OFF position. The GMTI (Ground Moving Target Inhibit) 0, 1, and 2 positions on the right provide an approximate increase of 20 knots of ground moving target rejection. The GMTI FS 3 position provides an approximate increase of 40 knots of GMT rejection. This further reduces the possibility of ground vehicles causing unwanted target returns on the VSD. However, GMTI FS 3 will increase blind zones in A/A target search. The numerals on the left provide the same GMTI properties as the previous system (approximately 50 knots).

In RAM, a frame store selection accomplishes the same data aging and GMTI functions for scan phase hits with the exception that a frame period consists of one scan and one spotlight phase. Pressing frame store ERASE immediately erases scan targets and all track file targets and track file data except the designated target.

Frame Store, Beacon Mode

The frame store knob acts as a gain control in the beacon mode. A strong return signal can cause the beacon display to saturate (multiple codes appear). The pilot can adjust the frame store knob to reduce the return signal level until a readable code appears. The higher settings provide greater signal attenuation; the normal setting is 1 or 2. The frame store selection is displayed in the VSD BIT window during BCN mode operations.

RADAR MODE CONTROL SWITCH

The MODE CONTR toggle switch (figure 1-11) provides the following radar functions in the A/A, VI, and ADI master modes. (The switch is not functional in the A/G master mode).

MAN	The pilot selects all radar operating parameters; range, azimuth/bar scan in the normal search modes. Any radar MODE SEL position may be selected. Auto range scale switching is disabled.
AUTO	The initiatized radar search mode and operating parameters are determined by the weapon mode selected on the throttle weapon switch. The parameters may be manually changed (except in gun mode) by positioning the appropriate control. It may be necessary to switch out of a setting and then return to get the desired parameter. When the radar is reinitialized (break lock, changing the weapon mode, etc.), the AUTO parameters reappear. In the A/A and VI master modes, only A/A modes can be selected on the MODE SEL knob. MAP can be selected in the ADI master mode. Auto range scale switching is enabled. (After TO 1F-15-618) If MRM is selected on the throttle, the only parameter automatically selected is the LRS search mode. All other search parameters are initialized at the settings established on the RSC.

Auto Range Scale Switching

The following auto range scale switching functions occur only if the MODE CONTR is in AUTO.

Radar Search	In the MRM or SRM weapon modes, if the pilot moves the acquisition symbol to the top (99 percent) or bottom (1 percent) of the VSD, the display changes to the next higher/lower range scale respectively and the acquisition symbol appears in the center of the display.
Radar Track	If the target moves beyond 95 percent of the displayed range (99 percent in 10 mile), the next higher range scale is selected. If the target moves to less than 45 percent of the displayed range, the next lower range scale is selected.

If radar track is lost (by any method), the acquisition symbol is placed at the last valid target position. If track is lost (not pilot induced), the range scale is not reinitialized until the auto reacquisition period is complete (3 to 6 seconds). If the pilot selects REJECT, the radar returns to the original AUTO mode parameters for the weapon selected.

(After TO 1F-15-618) If radar track is lost (pilot induced or not), the radar returns to the original AUTO mode parameters for the weapon selected.

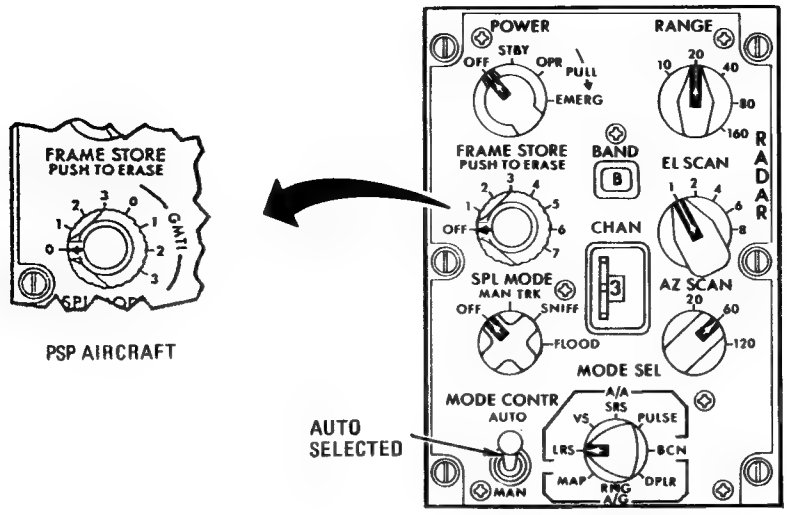
RADAR MODE SELECT KNOB

The radar mode (MODE SEL) knob is used to manually select the desired radar operating mode. In all master modes except A/G, any radar mode can be manually selected with the MODE CONTR in MAN. (Before PSP) In AUTO, only air-to-air modes can be selected except that MAP can be selected in ADI master mode. In PSP aircraft, the AUTO position of the MODE CONTR combined with the MAP position will select the Doppler Beam Sharpening (DBS) map mode. Refer to TO 1F-15C-34-1-2 for description of A/G radar modes.

SPECIAL MODE KNOB

This control is used to select any one of the three radar special modes described previously: manual track (MAN TRK), SNIFF, or FLOOD. The modes are inhibited as long as radar lockon exists. To reinstate a normal search mode, the SPL mode knob must be manually placed to OFF.

RADAR AUTO MODE PARAMETERS



RADAR SET CONTROL (RSC)

THROTTLE WEAPON SWITCH	RADAR RANGE (NM)	AZ SCAN	EL SCAN	TRANSMITTER MODE
MRM	[1] 40	[1] 120°	[1] 4-BAR	LRS
SRM	20	60°	[2] 4-BAR (2.5° BAR) SPACING	SRS
[3] GUN	10	60°	20° 6-BAR (3.4° BAR) SPACING	SRS AUTO ACQ

[1] After TO 1F-15-618, range, AZ and EL scan parameters are initialized to the settings existing on the RSC when MRM is selected.

[2] Bar spacing changes to 1° if 40 mile range is selected.

[3] Search parameters cannot be changed. Scan is positioned in AZ/EL by the throttle TDC. After lockon, bump auto acq. available by selecting REJECT.

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Figure 1-11

AUTOMATIC ACQUISITION SWITCH (Control Stick)

The auto acquisition switch is a four position switch spring loaded to the neutral (OFF) position (figure 1-10). The forward position alternately selects the supersearch or BST auto acquisition mode. The rear position selects vertical scan. The modes are inhibited if the radar is in track or FLOOD operation.

In PSP aircraft with radar lockon, the forward position commands RAM track. In RAM track, the rear position commands the RAM relative altitude display.

The momentary REJECT position terminates any acquisition or track mode and returns the radar to the selected search mode. In SNIFF special mode, the REJECT position temporarily initiates active radar transmissions. In the auto gun scan mode, REJECT will reposition the search scan to 0° AZ/EL. In track, REJECT selection will initiate bump auto acquisition.

ANTENNA ELEVATION CONTROL (Throttle)

The antenna elevation control (figure 1-10) positions the center of the selected bar scan pattern through ±40° in elevation. The control output is not used in STT or RAM track, or the auto acquisition modes. Rotation to the rear moves the antenna up in elevation. The elevation change may be noted by checking the elevation caret and scale on the left border of the VSD and by observing VSD altitude coverage data.

TARGET DESIGNATOR CONTROL, TDC (Throttle)

The target designator control on the throttle is an isometric positioning device which includes a depressible action switch. When the TDC is not pressed, the target acquisition symbol on the VSD is positionable at a rate proportional to the amount of force applied to the control. A left/right force controls the symbol in azimuth; an up/down force controls the symbol in range (or range rate in a VS mode). When the TDC is pressed (action position), the radar antenna is slaved to the acquisition symbol azimuth position. Releasing the TDC commands radar lockon in any A/A mode except BCN.

The TDC is also used to position the auto gun scan pattern in AZ/EL. The position of the VSD acquisition symbol indicates the center of the auto gun scan pattern.

LOCK/SHOOT LIGHTS

These lights (figure 1-10) provide the following indications. (There is no nomenclature on the face of the lights.)

ON (steady)	The radar is angle tracking a target (locked on).
ON (flashing)	In MRM/SRM modes, the CC has generated the shoot cue indication. (Refer to HUD Displays, MRM and SRM symbols).

When the pilot dims the cockpit lights for night operations (selects RESET on the caution/warning lights knob), the lock/shoot lights are disabled.

RADAR BIT (Built-In-Test) SYSTEM

The radar BIT system checks radar performance and the validity of radar parameters input to the CC. All missile launch computations (head aim, English bias, etc.) are performed in the CC. The CC BIT checks CC operation to ensure the proper operation of the CC program which utilizes the radar inputs.

The essential BIT operations associated with the radar system are:

a. The continuous monitor BIT (CM-BIT), which is continuously in operation as soon as radar power knob is moved out of the OFF position.
b. The initiated BIT (I-BIT), which is initiated through the BIT control panel (BCP, figure 1-12) with the radar power knob in OPR.
c. The BIT track test options which are available during the I-BIT routine.
d. The BIT matrix readout (figure 1-12) which can be commanded on the VSD in the BIT window, initiated through the BCP and with the radar power knob in STBY. The radar BIT matrix is the area of radar data processor memory which automatically records any failure occurrences during CM or I-BIT routines.

All procedures associated with controlling BIT operations (b) through (d) can be conducted by the pilot either on the ground or while airborne. The CM-BIT routine requires no switching procedure other than to apply radar power. The radar 3 minute warm-up period must be completed before any radar BIT checks can be conducted from the BCP. The MRM tune period must be completed before the I-BIT can be performed.

RADAR BIT CONTROLS

The BIT control panel (figure 1-12) contains the controls and indicators required to initiate the BIT operations listed previously in items (b) through (d). The radar control panel and the auto acquisition switch are also utilized in BIT operations.

BIT System Select Knob

The BIT system select knob must be positioned to RDR to perform the I-BIT routine or to command the BIT matrix readout on the VSD. Selecting RDR places the BIT initiate button into the BIT test network for the radar system.

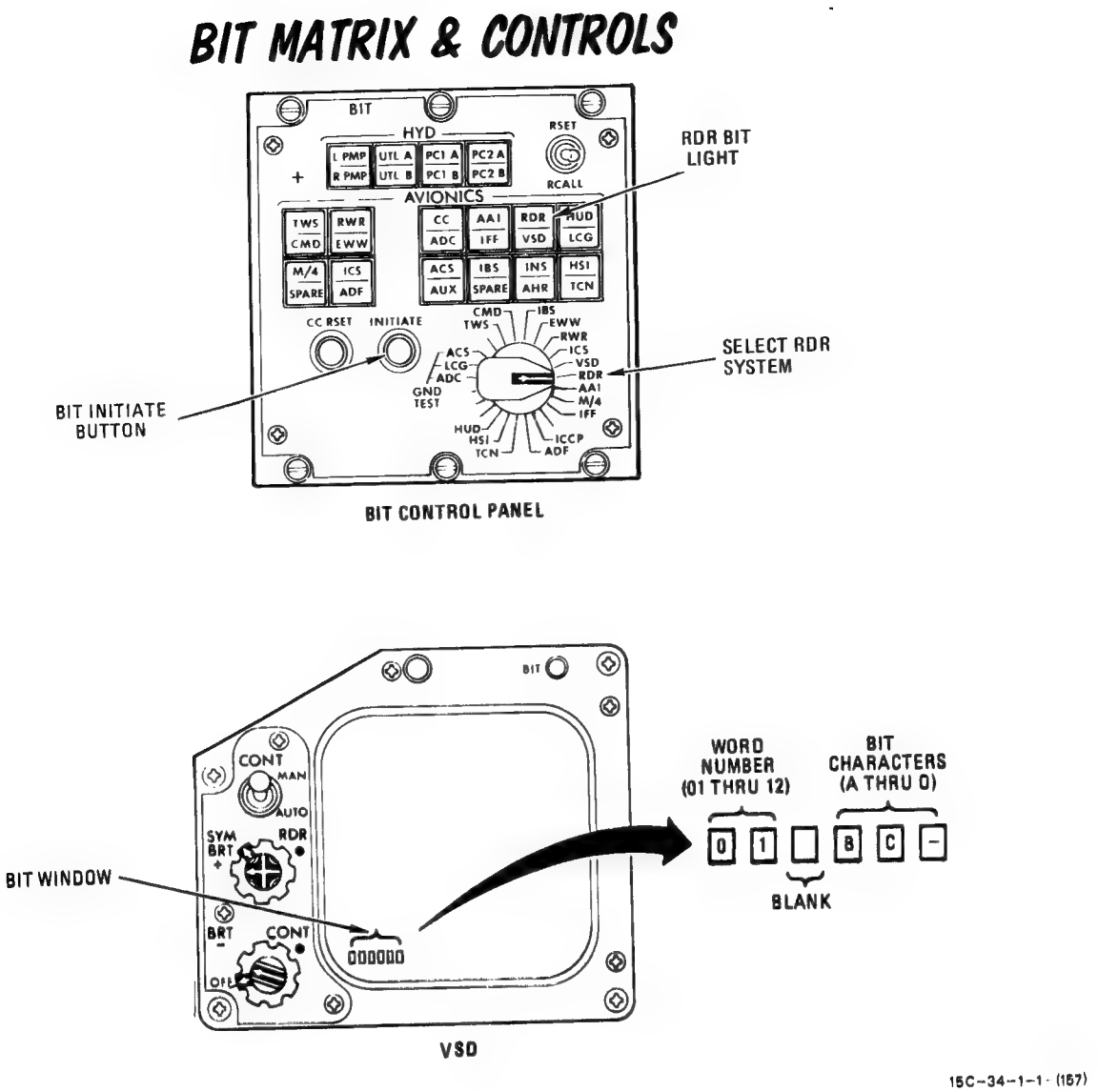


Figure 1-12

BIT Initiate Button

The functions of the initiate button depend on the position of the radar power knob. In radar STBY, pressing the initiate button commands the BIT matrix readout on the VSD. In radar OPR, the initiate button requests the I-BIT routine which requires approximately 2 minutes to complete. For the I-BIT, the missile tune cycle must have occurred or else the I-BIT request is ignored.

Radar BIT Light

The RDR BIT light (and the AV BIT light) illuminate (steady) to indicate a radar fault is detected by the BIT system. If the fault occurs during normal radar operations, the failure is recorded in the CM-BIT matrix. If the fault is detected during the I-BIT routine, then the failure is recorded in the I-BIT matrix. The RDR light flashes during the I-BIT routine and goes OFF when the test is complete or the BIT is terminated.

Auto Acquisition Switch BIT Functions

The reject position of the auto acquisition switch will immediately terminate any radar BIT operation commanded from the BCP; either the matrix readout sequence or the I-BIT routine. Either the forward or rear position will initiate the track test sequence during an I-BIT. Track test functions are described in later paragraphs.

RADAR BIT SYSTEM OPERATIONS

BIT Matrix

The pilot can command the matrix readout for several purposes: to validate the weight-on-wheels (WOW) interlock during ground operations; to read and record any failure data codes stored in the CM or I-BIT matrices; and to check the current tactical program stored in radar data processor main memory. The matrix readout on the VSD is accomplished by selecting RDR on the BIT system select knob, and pressing the BIT initiate button with the radar power knob in the STBY position. In the BIT window, TEST or G-TEST is displayed when the initiate button is pressed. The appropriate word is displayed for approximately 3 seconds before readout of the BIT matrices commences. The G-TEST display on the ground verifies the weight-on-wheels interlock system. When displayed in lieu of TEST, it indicates that it is safe to place the radar switch in the OPR position on the ground; no radiation hazard exists to nearby personnel.

As shown in figure 1-12, the radar displays the BIT matrix on the VSD in coded form; a word number followed by three alphanumeric characters. The codes are deciphered to determine the severity of radar degradation and to aid in troubleshooting radar failures. There are two 12-word BIT matrices that display failure data: one which stores the results of the last air or ground I-BIT and one which stores the results of all CM-BIT testing. During BIT matrix readout, I-BIT is displayed for 3 seconds preceding the I-BIT matrix; CM-BIT is displayed for 3 seconds preceding the CM-BIT matrix. Words 13 and 14 are always displayed last in a predetermined code form representing the tactical program currently stored in the radar data processor main memory (checksum).

Word 13	MDC
Word 14	BAF(Before PSP) CAA (After PSP) CAB (After TO 1F-15-737) CAC (AIM-7 tune update) CAD (After TO 1F-15-595)

After word 14, the sequence is complete and the VSD BIT window readout returns to the normal display of antenna EL bar and PRF. The sequence can be terminated anytime by pressing REJECT on the auto acquisition switch.

Radar CM-Bit

During radar operation, the CM-BIT monitors radar performance in the present radar mode and channel selected. If a failure is indicated (RDR and AV BIT lights ON) the pilot may select an alternate channel or mode which resets the lights (OFF), and then operate in that mode/channel unless a failure is again detected. The pilot also has the option of performing an I-BIT in an attempt to further define the true failure. In any case, the failure is placed into data processor memory and may be displayed by initiating the BIT matrix readout.

Radar I-Bit

The I-BIT routine provides an extensive test of the radar set in all channels and modes. The transmitter is checked for sufficient RF power on all channels in MED and HI PRF and in the BCN (LO PRF) mode. A transmitter failure in any channel or mode will cause the display of RF NG (RF NO-GO) in the VSD. Extensive self tests of the radar computer, power supply, antenna, analog and digital signal processors are also performed.

All of the above tests are performed during the I-BIT, whether airborne or on the ground. The only tests which are not performed during airborne I-BIT are the range delay calibration and certain antenna tests (i.e., gyro drift tests) which should be performed in a static environment.

The I-BIT is accomplished with the radar power knob in the OPR position. The BIT is started by selecting the RDR BIT system and pressing the momentary INITIATE button on the BIT control panel (figure 1-12). The BIT requires approximately 2 minutes to complete. All radar tactical operations are interrupted and the RDR BIT light blinks during the test. Failure to pass any test will cause the RDR light to cease blinking and illuminate steady. If I-BIT is performed on the ground, any failure data recorded in the CM-BIT matrix is cleared. Therefore, CM-BIT matrix data should be noted before a ground I-BIT.

The following display sequence is presented in the VSD BIT window during I-BIT.

a. G-TEST (ground) or TEST (airborne)
b. After 3 seconds, TK TST

NOTE

If the pilot chooses to enter the track test sequence, it must be done during the 7-second display of TK TST (item b). Otherwise the I-BIT starts (item c). Refer to BIT Track Test, in following paragraphs.

c. After 7 seconds, the display reverts to TEST or G-TEST and the I-BIT starts.
d. After 2 minutes (approx), the VSD BIT window returns to normal displays (bar, PRF) and the BIT light goes OFF.

If an I-BIT is terminated (before completion) by such occurrences as auto acquisition switch reject, power shutdown, power transients, computer or power supply

anomalies, then the I-BIT identifier and associated matrix will not be displayed during a subsequent matrix readout. In this case, only the CM-BIT matrix and checksum is read on the VSD. At the time the I-BIT is terminated, NO-BIT is displayed on the VSD for 7 seconds.

Radar Track Test

The track test is entered during the I-BIT (preceding item b) by selecting an auto acquisition forward or rear position within 7 seconds after TK TST appears in the BIT window. The I-BIT routine is interrupted during TK TST (BIT light goes OFF). The track test status may be maintained as long as desired and when terminated, the I-BIT continues to completion. The track test allows the operator to exercise the radar acquisition and tracking functions. The test provides a check of the velocity and range tracking servos, the angle tracking servo, and checks the display interface between the HUD and VSD. When track test is entered, test targets appear on the VSD and the antenna is scanning. The pilot must select 0° antenna elevation and 120° azimuth scan to properly observe all targets (figure 1-13). In LRS, HI PRF and MED PRF targets appear alternately with each scan. The MED PRF targets appear at 7, 9, and 11 miles. The HI PRF targets appear at 24 $\pm$2 miles. The VS targets appear at approximately 390, 830, 1270 and 1790 knots. Before PSP, test targets also appear in the MAP and PULSE radar modes; however, test lockon operations are not available in PULSE. In MAP, moving the VSD RDR gain control toward the fully CW position causes more test targets to appear.

After PSP, test targets do not appear in MAP, and PULSE mode test targets are the same as the SRS mode.

NOTE

The MED PRF 7-mile targets may be intermittent or completely missing.

There are several track tests available to the pilot. For example, with the radar MODE CONTR in MAN and LRS/40 NM range selected:

a. Use the TDC and execute a manual lockon of any 24-mile target. Observe the VSD search, acquisition, and track displays. The pilot must REJECT lockon before an auto acquisition mode can be selected.

b. Select VS and use the TDC to acquire any available target. Observe that the initial velocity track display appears for 1.5 seconds, then changes to a range track display. Move the weapon switch through all positions and observe the HUD/VSD GUN, SRM, and MRM displays. Press REJECT to return to search.

c. Place the radar mode control to AUTO. Move the throttle weapon switch through all positions and observe the VSD and HUD AUTO search display parameters change accordingly.

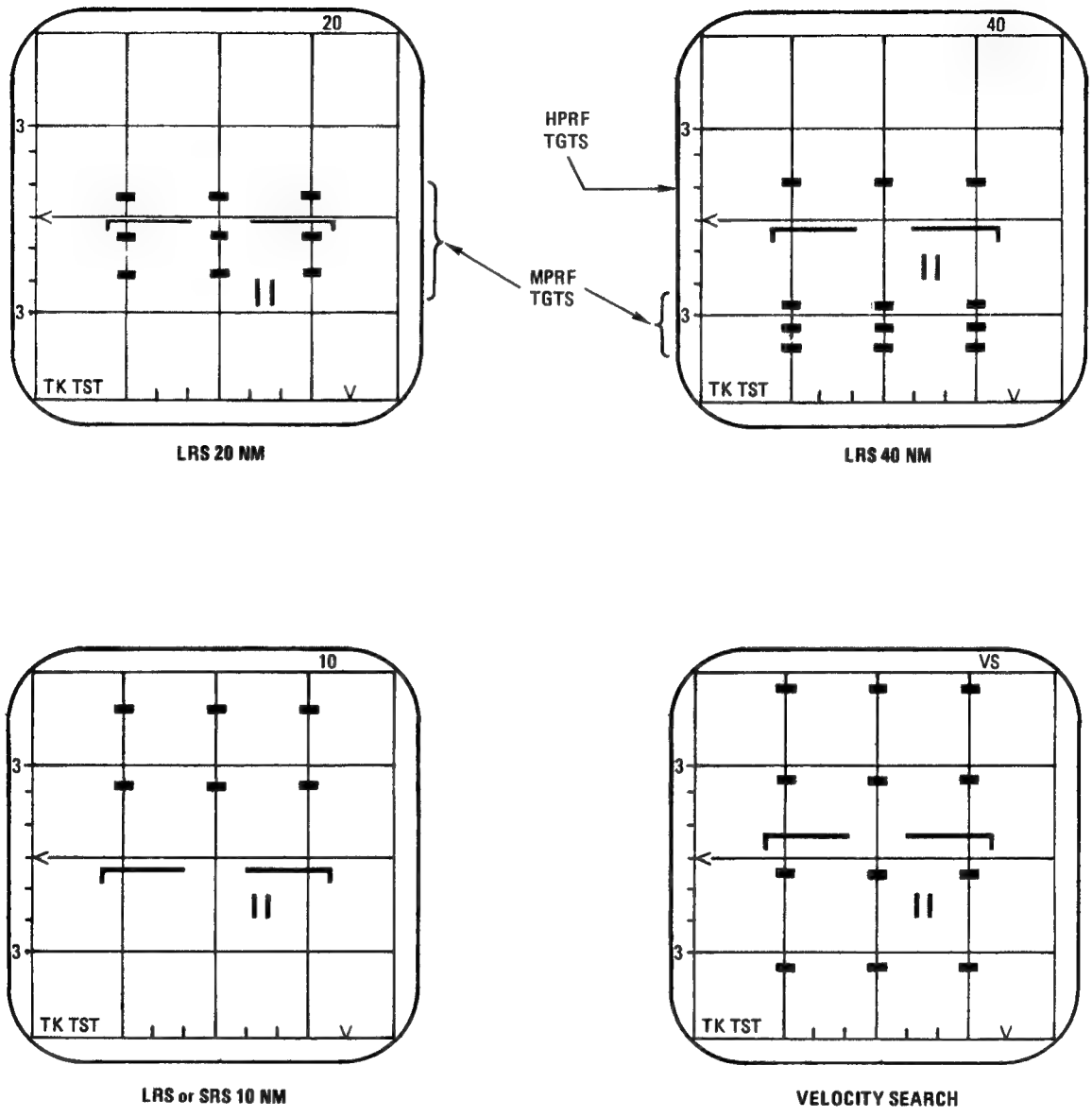
d. To reject the track test mode, press the BIT initiate button; the test displays go OFF, the VSD BIT window reverts to G-TEST (or TEST), and the I-BIT routine starts.

During the track test, the attack display symbols (ASE circle, range rate, Rmax/Rmin) will vary in size or location depending on the target being tracked. (Additional information is available in TO 1F-15C-2-25-1).

To aid maintenance personnel in troubleshooting radar failures the pilot can record the BIT matrices prior to and after flight. The airborne or ground I-BIT may also be performed by the pilot (when a radar failure is suspected) in order to yield a better insight into the nature of the failure and to obtain the more complete fault isolation afforded by I-BIT.

TRACK TEST DISPLAY

(SEARCH MODE, TEST TARGETS)



15C-34-1-1-(161)

Figure 1-13

ARMAMENT CONTROL SET (ACS)

All functions which pertain to munitions selection, monitoring, arming, jettisoning, and release sequencing occur through this equipment. The system provides the primary electrical interfacing between the pilot's commands, the munitions aboard, and the rest of the aircraft avionics in the weapon attack modes.

ARMAMENT CONTROL PANEL (ACP)

The controls on the ACP that pertain to A/A operations are the gun controls, missile station status indicators, monitor and option indicators (AIM-9L missile), and master arm switch. The essential A/A functions of the panel are shown in figure 1-14.

MASTER ARM SWITCH

The master arm switch is a two position, lever-locked toggle switch. Power is available for the switch when the landing gear handle is UP or when the armament safety switch is in OVERRIDE.

SAFE	Weapons cannot be employed.
ARM	Power is available to employ any weapon aboard the aircraft. The gun cross symbol is displayed on the HUD.

GUN RATE SWITCH

The gun rate switch is a two-position toggle switch that controls the firing rate of the M61A1 gun.

LO	Selects 4000 SPM (shots per minute) firing rate.
HI	Selects 6000 SPM firing rate.

GUN ROUNDS REMAINING COUNTER

The gun ROUNDS counter is set to indicate the total rounds loaded in the gun, and then counts down in 10-round increments as the gun is fired. The quantity set in the counter is repeated in HUD window 2 when A/A gun steering is selected.

JETTISON CONTROLS

Refer to Stores Jettison System, this part, and to section III.

MISSILE STATUS INDICATORS

Missile status monitoring functions are provided for each heat and radar missile aboard the aircraft by the missile status indicators. As soon as aircraft power is available, the ACS provides an MRM and an SRM (SW) indication for those stations containing a missile. The additional indications the pilot sees throughout the missile preparation and launch sequence are shown in figure 1-14.

WARNING

An MRM station RDY indication should occur only on one station legend. If two (2) or more stations show a RDY status, a simultaneous launch of 2 or more missiles can occur. In this situation MRM launch should not be attempted.

NOTE

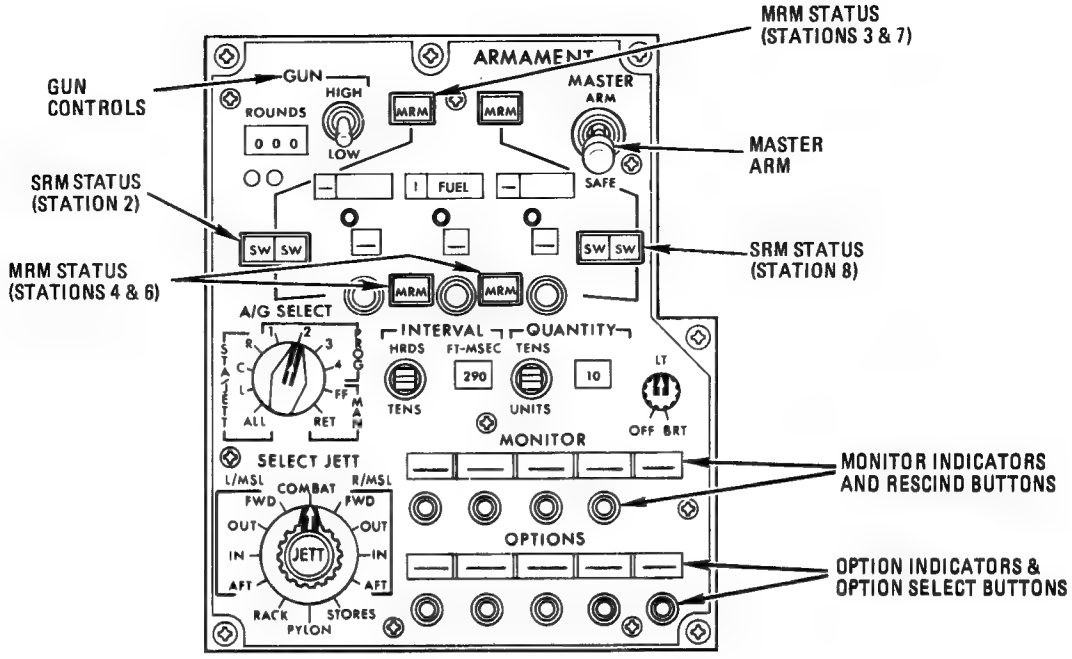
The pilot may encounter a situation where the MRM tuned signal is not sensed by the ACS even though missiles have properly tuned. For example, the pilot observes the proper tuned status on the HUD/VSD, but the ACP missile legend does not change to STBY. In this situation, the legend can be made to change by changing the position of the throttle weapon switch, or by momentarily positioning the interval or quantity switch on the ACP.

OPTION AND MONITOR INDICATORS (AIM-9L)

The AIM-9L seeker head cooling and scan (nutation) status is displayed in the first and second option and monitor indicators (figure 1-14, sheet 1). COOL and SCAN appear in the monitors when the respective functions have been either automatically commanded or manually selected by the pilot. Conversely COOL and SCAN appear in the options when the functions are not selected or have been rescinded by the pilot. The COOL and SCAN display in the monitors is an indication that the functions are selected, and not an indication that the ACS has output the signals or that the priority missile has responded to the signals. The SRM audio tone must be utilized to check missile response.

ARMAMENT CONTROL PANEL

AIR-TO-AIR FUNCTIONS



OPTIONS

AIM–9L COOL/SCAN RESCINDED

MONITOR

AIM–9L COOL/SCAN ENABLED

MRM STATIONS

DISPLAY LEGEND	STATUS
MRM	MISSILE ABOARD
STBY	MISSILE ABOARD AND TUNED
[1] RDY	MISSILE ABOARD AND TUNED, MRM SELECTED ON THROTTLE, A/G NOT SELECTED, MASTER ARM PRESENT, MISSILE SELECTED FOR LAUNCH.
HUNG	SELECTED MISSILE ABOARD AFTER LAUNCH (OR JETTISON) COMMAND APPLIED TO THAT MISSILE
–(dash)	NO MISSILE ABOARD
[2] FAIL	FAILURE WHICH INHIBITS LAUNCH OF ALL RADAR MISSILES

SRM STATIONS

DISPLAY LEGEND	STATUS
SW	MISSILE ABOARD
[1] STBY	MISSILE IN PRIORITY, SRM SELECTED ON THROTTLE
[1] RDY	MISSILE IN PRIORITY, SRM SELECTED ON THROTTLE, A/G NOT SELECTED, MASTER ARM PRESENT
HUNG	SELECTED MISSILE ABOARD AFTER LAUNCH (OR JETTISON) COMMAND APPLIED TO THAT MISSILE
–(dash)	NO MISSILE ABOARD
[2] FAIL	FAILURE WHICH INHIBITS LAUNCH OF ALL HEAT MISSILES

[1] APPEARS IN ONE STATION INDICATOR AT A TIME.

[2] APPEARS IN ALL INDICATORS.

15C–34–1–1–(31–1)A

Figure 1-14 (Sheet 1 of 2)

ARMAMENT CONTROL PANEL (*Continued*)

AIM 9L COOL OPTION

	A/G SELECT	MASTER ARM	A/A WEAPON SELECT	MONITOR DISPLAY	OPTION DISPLAY	COOL ON	CONDITIONS
1)	NO	SAFE	ANY	–	COOL	NO	AIM–9L aboard
2)	NO	SAFE	ANY	COOL	–	YES	Pilot has selected COOL option
3)	NO	ARM	ANY *	COOL	–	YES	Master arm enables COOL. COOL can be rescinded in MRM or GUN, but not in SRM.
4)	YES	SAFE	MRM or SRM	Used for A/G	Used for A/G	YES	Pilot previously selected COOL (by method 2 or 3), then selected A/G. A/G must be deselected to rescind COOL.
5)	YES	ARM	MRM or SRM *	Used for A/G	Used for A/G	YES	COOL enabled by master arm.

* If COOL was previously rescinded, COOL is output only in SRM.

15C–34–1–1–(31–2)A

Figure 1–14 (Sheet 2)

Scan Selection

When SRM is selected on the throttle, nutation is automatically commanded for the priority AIM–9L. SCAN appears in the second monitor until SRM is deselected or until the pilot rescinds SCAN by pressing the SCAN monitor button. In the latter case, SCAN appears and remains in the second option until SRM is deselected, A/G is selected, or until the pilot reselects the SCAN option. Once the pilot manually rescinds SCAN, cycling the weapon select or master arm switch will not reinstate SCAN; SCAN must be manually selected by pressing the SCAN option button.

Cool Selection

Seeker head cooling is enabled for all AIM–9L missiles by methods shown in figure 1–14, sheet 2. With A/G not selected and the AIM–9L missile–aboard signal present, COOL appears in the first option (case 1). The pilot can press the COOL option button and initiate cooling (case 2), or select SRM and master arm and get cooling automatically (case 3). However, if the COOL function has ever been manually rescinded, automatic cooling is obtained only when the weapon switch is in SRM. Using either method, COOL appears in the first monitor. Cases 4 and 5 in the table relate situations in which COOL is enabled but not displayed.

AIM–7F SIMULATOR PLUG

The AIM–7F simulator plug is a training device installe in the LAU–106/A launcher to simulate the ACP AIM–7 missile indications. (See AIM–7F Exterior Inspection, section II.) The simulator plug(s) provide the following displays on the ACP MRM station legend(s).

MRM	Simulator plug aboard.
STBY	Radar has entered the TUNE (OPR) mode; HUD window 2 indicates the number of tuned missiles.
RDY	MRM selected, master arm switch in ARM, station in priority.
HUNG	Missile launch signal applied to RDY station; HUD window 2 weapon count reduces by number of stations showing HUNG.

The HUNG indications can be reset to MRM by placing the radar power knob to OFF and repeating the normal STBY to OPR time–out sequence (approximately 3 minutes).

CAUTION

The AIM–7F simulator plug should never be installed in conjunction with live AIM–7F missiles. A mixed load of simulator plugs and live missiles will cause tuning and launch anomolies.

STICK GRIP AND THROTTLE CONTROLS

The stick and throttle controls used for A/A weapons applications are shown in figure 1-15. These controls are designed to enable immediate control of the present attack mode so that in a visual situation, the pilot need not look in the cockpit. The commands generated by all of these controls are interfaced with the attack mode avionics by the central computer, and interfaced with any weapons aboard by the armament control set. In F-15D aircraft, the comparable rear cockpit stick and throttle controls are not functional.

ADDITIONAL CONSIDERATIONS

MRM TO SRM SWITCHING

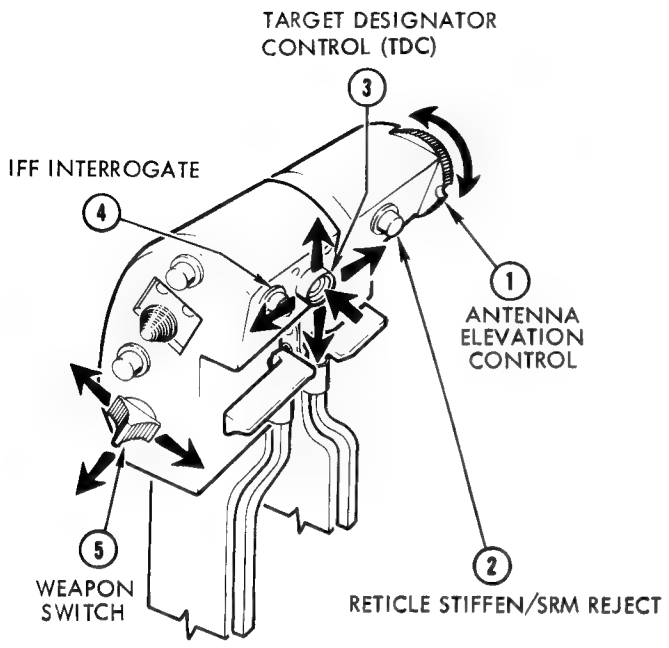
When the weapon release button is pressed to launch an MRM, the delay between launch signal application and MRM eject is approximately 1.4 seconds. If the pilot rapidly switches the throttle weapon switch from MRM to SRM before the launch delay has elapsed, the MRM launch may abort. The ACS will show the HUNG indication and the missile is lost from the firing sequence. If the pilot launches an MRM and holds the release button while switching to SRM, there is no danger of ripple-launching two missiles (an MRM followed by an SRM). The launch signal must be released and then reapplied to fire a second missile.

SRM TO MRM SWITCHING

When the SRM launch signal is applied, launch is almost immediate (approximately 0.5 second delay). If the pilot inadvertently holds the launch signal and switches to MRM, the MRM launch signal is applied and the ripple-launch of two missiles will occur (an SRM followed by an MRM).

STICK GRIP & THROTTLE CONTROLS

A/A ATTACK MODE FUNCTIONS



(1) Controls centerline of antenna elevation scan pattern.

(2) Gun mode: Provides fixed, 1000-foot range signal to primary reticle when held pressed.

SRM mode: Momentarily pressed to reject selected SRM and select the next missile in the launch sequence.

(3) Not Pressed: Controls VSD acquisition symbol.

Pressed: Slaves antenna to VSD acquisition symbol. Initiates acquisition scan.

Released: Radar lockon command.

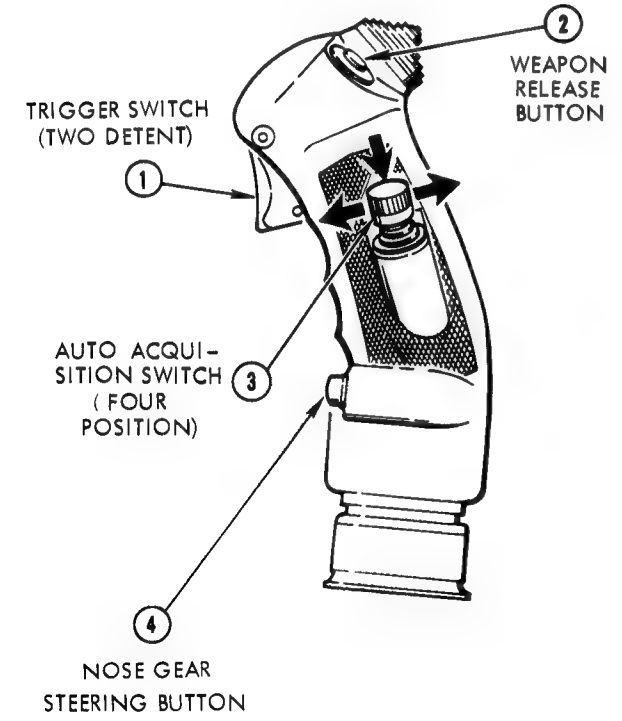
(4) Pressed: Starts IFF interrogate. Selects AIM-9L seeker manual boresight.

Released: AIM-9L returns to radar antenna LOS.

(5) Rear: Selects A/A attack mode with gun steering.

Center: Selects SRM with SRM steering.

Forward: Selects MRM with MRM steering.



(1) Trigger 1: HUD camera(or VTR)operate.

Trigger 2: Gun fire and HUD camera(or VTR)operate.

(2) Pressed: SRM or MRM Launch and MRM illumination; HUD camera(or VTR)operate.

(3) Forward: (Rdr Search) Alternately selects BST or SS auto acq. (Rdr track, PSP) Alternately selects RAM or STT display.

Rear: Selects vertical scan auto acq mode. (PSP) Selects RAM relative alt. display.

Down: Rejects any acquisition or tracking mode; returns radar to search mode.

Center: Spring loaded OFF.

(4) Initial Actuation: Uncages SRM seeker and enables self-track (UNC on VSD).

Second Actuation: (ALM-9J/P) seeker returns to BST.
(AIM-9L) seeker returns to antenna LOS (Radar track) or to BST (Radar search).

15C-34-1-1-(39)D

Figure 1-15

HEAD-UP DISPLAY (HUD) SYSTEM

The HUD system is an electro—optical sight system that develops symbolic flight and attack steering information and projects the symbols into the pilot's field of view. The HUD display modes are governed by the master mode buttons. In A/A master mode, the MRM, SRM, or GUN attack display is selected by the throttle weapon switch.

The total field of view (FOV) of the HUD is circular, covering 20° in azimuth and elevation. The center of the FOV (optical axis) is 4° below waterline. The HUD includes a depressible, standby reticle display containing a 2 mil diameter aim dot and a 50 mil diameter circle centered about the dot.

HUD CONTROLS

All HUD controls are illustrated in figure 1–16.

SYMBOL KNOB

OFF	The entire HUD system is deenergized; the STBY reticle can be displayed using the STBY RTCL knob.
ON	Clockwise rotation energizes the HUD, HUD camera (before Block 24), lead computing gyro, and increases HUD symbol brightness.

STANDBY RETICLE (STBY RTCL) KNOB

OFF	The STBY reticle is OFF.
ON	Illuminates the STBY reticle, adjusts reticle brightness, and (before Block 24) energizes the HUD camera.

DAY/NIGHT SWITCH

DAY	Applies high voltage control range to all brightness controls.
NIGHT	Applies low voltage control range to all brightness controls.

AUTOMATIC/MANUAL BRIGHTNESS SWITCH

AUTO	Enables the HUD to maintain a consistent symbol brightness as a function of ambient light conditions. The AUTO position will not provide adequate illumination at night.
MAN	Symbol brightness remains at the level established by the pilot through the SYMBOL knob.

SYMBOL (SYM) SWITCH

The SYM switch enables the pilot to remove some of the data displayed on the HUD.

NORM	All HUD symbology is displayed.
REJ	Removes the airspeed scale, heading scale, altitude scale, AOA scale, and the pitch scale in all master modes. Removes the velocity vector in the A/A master mode.

RETICLE DEPRESSION KNOB

The depression knob provides reticle depression angle settings of 0 to 270 mils with respect to the gun boresight line (+2° above waterline). The depression control (and the depression counter) is functional for the primary and standby reticles.

RETICLE (RTCL) SWITCH

DSTB or AUTO	Provides lead compute gun steering in the gun A/A attack mode.
CAGED	Cages the gun (primary) reticle at the 0° depression (gun cross) position.

HUD DISPLAY SYMBOLS

In this description, the following operational categories of HUD symbology are considered.

a. HUD all–mode symbols, or symbols that are common to all master modes of operation.

HUD CONTROLS

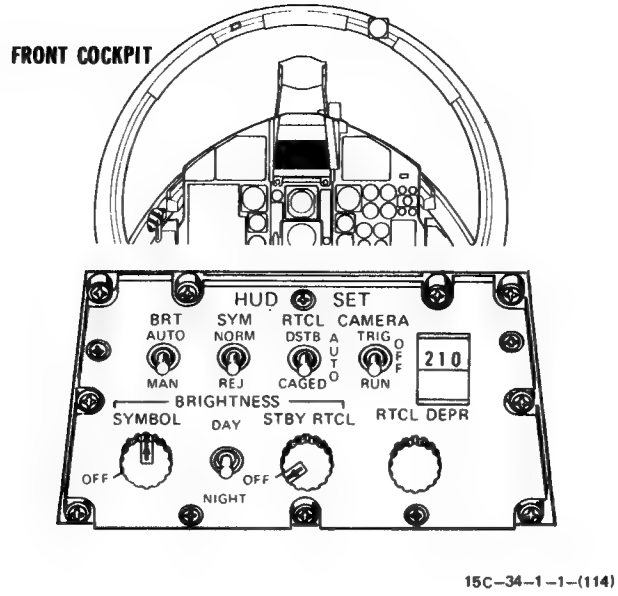


Figure 1-16

b. HUD window displays, alphanumeric data with fixed locations.
c. A/A attack mode displays;
(1) MRM steering
(2) SRM steering
(3) Gun steering
d. VI (Vis-Ident) mode display.
e. ADI mode; most ADI data is contained in TO 1F-15C-1. For continuity, some ADI symbology is described here.

HUD ALL-MODE SYMBOLS

The HUD symbols that can be displayed in any master mode of operation are shown in figure 1-17. The aircraft symbol, which is not displayed in all operational modes, shows a fuselage reference line (FRL) location. The 20° circle in figure 1-17 is shown only to approximate the HUD FOV and relative symbol locations.

Airspeed Scale

The indicated airspeed scale is displayed in 50-knot increments with 10-knot tick marks. The scale moves against a fixed caret (V) index.

Heading Scale

The heading scale moves horizontally against a fixed caret index indicating aircraft magnetic heading from 0° through 360°. The 2-digit display is expressed in degrees X10; e.g., 10° = 01, 250° = 25.

Altitude Scale

The moving altitude scale relates altitude from −100 to 80,000 feet. The reading is MSL or pressure altitude depending on the altimeter barometric setting. With the landing gear up, the numerics are displayed in 500-foot increments with 100-foot tick marks. With the gear down, the numerics are in 100-foot increments with 20-foot tick marks.

Gun Cross

The gun cross (figure 1-17) is fixed 2° above waterline in the azimuth center of the HUD and appears when the master arm switch is in ARM. The symbol indicates the projectile conversion point (without AOA or ballistic drop corrections) at the 2250-foot gun harmonization range. The symbol is also the position of the gun reticle pipper at zero mils depression (zero sight line). The gun cross is removed from the display by selecting the master arm switch SAFE position.

HUD SYMBOLS

ALL MODES

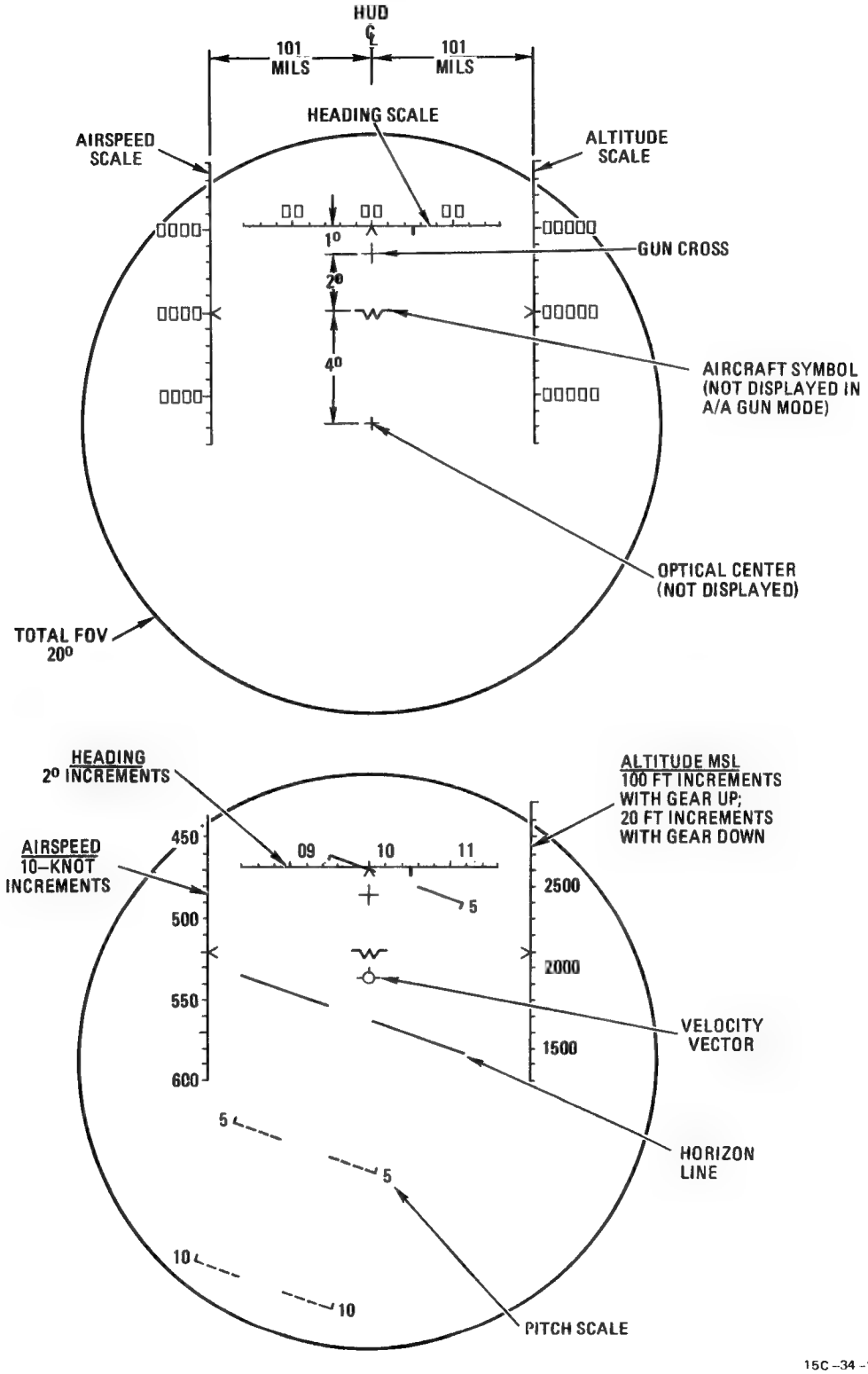


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Figure 1-17

Aircraft Symbol

The aircraft symbol is displayed in all but the A/A gun mode. The symbol is fixed and indicates a waterline or fuselage reference line (FRL), 2° (35 mils) below the gun cross and 4° (70 mils) above HUD optical center.

Velocity Vector

The velocity vector displays the instantaneous aircraft flight path with respect to earth coordinates. It is a small airplane symbol and the wings of the symbol always remain parallel to the wings of the aircraft. The vertical relationship between the aircraft symbol (when displayed) and the velocity vector indicates true angle of attack. Velocity vector azimuth displacement from HUD centerline indicates that drift (or a crab angle) is present. The vector symbol is limited to 8.5° radius of motion centered on the HUD FOV. The symbol flashes when it reaches the limit.

Pitch Scale

The pitch scale indicates $\pm$90° of pitch and 0° through 360° of roll. The scale includes a horizon line, solid positive pitch lines, and dashed negative pitch lines. The numerics are presented every 5° up to 30° of climb or dive angle, and every 10° from $\pm$30° to $\pm$90° (2/1 scale reduction). The small tick marks at the end of each pitch line point to the horizon. When the velocity vector is displayed, the scale remains centered upon and rotates about the vector symbol. Therefore, the scale and velocity vector indicate true flight path angle. The roll angle reference is the angle between the stabilized wings of the velocity vector and the pitch scale.

When the velocity vector is not displayed, the pitch scale remains centered upon and rotates about the airplane symbol. True FRL pitch is obtained throughout the full range of the scale.

HUD WINDOW SYMBOLS

There are eight HUD windows that display CC controlled data in alphanumeric format. The windows are located in the HUD FOV as shown in figure 1-18. The data displayed in the windows depends on the selected master mode of operation and in some cases, the operating status of a specific avionics set. The difference in cue locations between the before and after TO 1F-15-618 display configurations is shown in figure 1-18.

HUD Window 1

With radar lockon, the target opening (−) or closing velocity (in knots) is displayed. The window moves vertically opposite the moving caret index of the radar range scale (see MRM mode symbols).

HUD Window 2

GUN ROUNDS

In A/A gun mode, a display of the gun round status is provided. A numerical display indicates the approximate number of gun rounds on board and that some of those rounds are available for firing. An XXX display with the master arm switch in the ARM position indicates no gun rounds are available for firing. An XXX display with the master arm switch in the SAFE position may be an incorrect display. In the latter case, master ARM must be selected to be sure of the actual gun round status.

MISSILE COUNT

In A/A missile modes (or in VI), the number of useable SRM or MRM missiles in a STBY or RDY status is displayed when the respective positions are selected on the throttle weapon switch. With SRMs aboard after TO 1F-15-618, the HUD initially displays the S4 cue, which is the correct display for the AIM-9L or the AIM-9J-2/-3/P-2/-3. If the AIM-9J/J-1/P/P-1 is aboard, the corresponding CC program (S4J cue) must be selected on the NCI panel.

HUD Window 3

IN RANGE

The IN RNG cue is displayed to indicate that the target is within the seeker and guidance capability of the selected missile. If MRM is selected, the cue flashes when target range is less than Rmax 1 and less than missile seeker detection limit, but greater than Rmax 2. The cue is steady when range is between Rmax 2 and Rmin. Before TO 1F-15-618, if SRM is selected, the cue flashes when target range is between Rmax and Rmin. After TO 1F-15-618, the SRM IN RNG cue remains steady.

NO ZONE

Refer to VSD Window Displays and to AIM-7F Missile, TO 1F-15C-34-1-1-1.

RADAR SPECIAL MODES (In Window 4 After TO 1F-15-618)

The MN TRK (manual track), SNIFF, or FLOOD cue is displayed in window 3 when the radar is operating in one of these special modes. Refer to Radar Set, this part. The MN TRK mode is not functional in PSP aircraft.

ADI NAV MODES

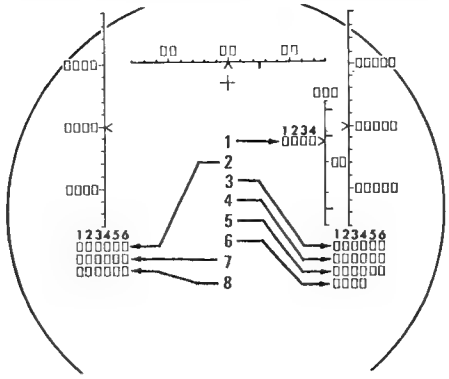
The remaining cues shown in window 3 are applicable to the ADI mode only. They show the NAV mode the pilot has selected on the NCI and steer mode panels. (See window 5, TACAN Range.)

HUD Window 4

TRACK MEMORY (In Window 3 After TO 1F-15-618)

HUD WINDOW DISPLAYS

A/A, ADI, AND VI MODES



BEFORE TO 1F–15–618

1 2 3 4	WINDOW 1
1 1 5 0	RANGE RATE, ±KTS.
1 2 3 4 5 6	**WINDOW 2**
7 0 0	ROUNDS REMAINING
M 4	MRM COUNT
S 4	SRM COUNT
M K R	ILS MARKER
1 2 3 4 5 6	**WINDOW 3**
I N R N G	IN RANGE (SRM, MRM)
N O Z N	NO ZONE (SRM, MRM)
M N T R K ⟨1⟩	RADAR SPECIAL MODE
S N I F F	RADAR SPECIAL MODE
F L O O O	RADAR SPECIAL MODE
N A V	ADI STEERING MODES
T C N	ADI STEERING MODES
I L S – N	ADI STEERING MODES
I L S – T	ADI STEERING MODES
1 2 3 4 5 6	**WINDOW 4**
M E M	TRACK MEMORY
J A M	RADAR JAM CODES
A O J	RADAR JAM CODES
H O J	RADAR JAM CODES
8 6 N M	RADAR RANGE (A/A, VI)
1 2 3 4 5 6	**WINDOW 5**
H D A L T	HOLD ALTITUDE (MRM)
5 0 S E C	MRM TIME–TO–GO
4 8 . 3	TACAN RANGE (A/A, VI, ADI)
1 2 3 4	**WINDOW 6**
C S E T	COURSE SET (ILS)
G S U P	GLIDESLOPE UP (ILS)
G S D N	GLIDESLOPE DOWN (ILS)
U N C	UNCAGE (SRM)
R A M	RAM MODE
1 2 3 4 5 6	**WINDOW 7**
I . I 5 5	AIRCRAFT MACH
1 2 3 4 5 6	**WINDOW 8**
T M I . 5	TARGET MACH
2 . 5 G	AIRCRAFT G

AFTER TO 1F–15–618

1 2 3 4	WINDOW 1
1 1 5 0	RANGE RATE, ±KTS.
1 2 3 4 5 6	**WINDOW 2**
7 0 0	ROUNDS REMAINING
M 4	MRM COUNT
S 4	SRM COUNT
S 4 J	SRM COUNT (AIM–9J/P W/MK–17)
M K R	ILS MARKER
1 2 3 4 5 6	**WINDOW 3**
J A M	RADAR JAM CODES
H O J	RADAR JAM CODES
A O J	RADAR JAM CODES
M E M	TRACK MEMORY
H D A L T	HOLD ALTITUDE
N O Z N	NO ZONE
I N R N G	IN RANGE
N A V	ADI STEERING MODES
T C N	ADI STEERING MODES
I L S N	ADI STEERING MODES
I L S T	ADI STEERING MODES
1 2 3 4 5 6	**WINDOW 4**
M N T R K ⟨1⟩	RADAR SPECIAL MODES
S N I F F	RADAR SPECIAL MODES
F L O O D	RADAR SPECIAL MODES
R 2 6 . 5	RADAR RANGE
T 1 2 6 . 5	TACAN RANGE
N 1 2 6 . 5	NAV RANGE
1 2 3 4 5 6	**WINDOW 5**
3 5 S E C	MRM Tgo
3 5 M I N	NAV, TCN Tgo

NOTE

WINDOWS 6, 7 AND 8 ON HUD DISPLAYS AFTER TO 1F–15–618 ARE THE SAME AS HUD DISPLAYS BEFORE TO 1F–15–618.

⟨1⟩ DELETED AFTER TO 1F–15–606

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Figure 1-18

Refer to VSD Window Displays.

RADAR JAM CODES (In Window 3 After TO 1F-15-618)

The JAM codes override all other window 4 displays. Refer to TO 1F-15C-34-1-1-1.

RADAR RANGE (Before TO 1F-15-618)

When the radar is range tracking in the A/A or VI modes, the radar range to target is displayed on the HUD to the nearest nautical mile, except when limited by the maximum readout of 86 nautical miles. The minimum value displayed is zero when range is 0.5 NM or less. The display is overridden by all other window 4 displays: MEM, AOJ, HOJ and JAM.

RANGE DISPLAYS (After TO 1F-15-618)

With the exception of the special mode cues, window 4 will always display range data. A prefix letter identifies the display as R (radar), T (TACAN), N (Nav), or G (A/G) designated range. Ranges are displayed with a resolution of 0.1 NM to a maximum of 999.9 NM. The radar range still has a maximum of 86 NM. Refer to TO 1F-15C-34-1-2 for A/G mode data.

HUD Window 5

HOLD ALTITUDE (In Window 3 After TO 1F-15-618)

Refer to VSD Window Displays.

TACAN RANGE (In Window 4 After TO 1F-15-618)

In the A/A, VI and ADI modes, TACAN range is displayed to the nearest tenth of a nautical mile. In the ADI mode, the range displayed in window 5 is identified in window 3; either NAV, TCN, ILS-N or ILS-T. In the A/A and VI modes, the TACAN range is displayed in window 5 but it is not identified in window 3.

MRM TIME-TO-GO (Tgo)

The MRM Tgo display represents AIM-7 missile time of flight (in seconds). Before MRM launch, the symbol is steady and appears in radar track when target range is within Rmax 1 and Rmin. The value is the predicted MRM time of flight and is continuously updated as range/angle conditions change. When MRM launch occurs, the Tgo symbol flashes and begins a real-time countdown to zero seconds, which is the missile impact time for non-maneuvering conditions.

MRM TIME-TO-GO (Tgo) (After TO 1F-15-618)

Window 5 will exclusively display the Tgo cues associated with the steering modes and ranges displayed in adjacent windows 3 and 4. The MRM prelaunch Tgo cue is mechanized as stated in the preceeding paragraph. The postlaunch Tgo, a function of target position and velocity data, provides an accurate display of the required illumination period. The indications are as follows.

Target does not maneuver	Flashing Tgo counts down in real time.
Target maneuvers, staying in range	Flashing Tgo countdown adjusted for target maneuvers.
Potentially lost missile, target maneuvering toward missile limit.	LOSING is displayed alternately with Tgo.
Actual lost missile (target moves beyond missile limit), or loss of RDR track due to mode REJECT or exceeding antenna gimble limits.	Flashing Tgo terminated. Next missile prelaunch Tgo displayed after 5 seconds.
Flood Launch	Flashing Tgo counts down in real time.

HUD Window 6

Window 6 is used for ADI mode ILS operations. See TO 1F-15C-1 for ILS Nav/TACAN information, ADI mode.

RAM

In PSP aircraft, the RAM cue is displayed when the radar enters the RAM track mode.

UNCAGE

UNC is displayed when the nose gear steering button is pressed an odd number of times to permit SRM seeker self-track (IR lockon). An even number of button depressions removes UNC from the HUD, breaks IR lockon, and returns the AIM-9L seeker to the missile boresight or to the radar antenna LOS.

HUD Window 7

Window 7 displays the present aircraft Mach in any A/A mode and in VI operations.

HUD Window 8

The target Mach number is displayed only in the VI mode. In all other modes, the window displays the present aircraft G.

HUD MRM MODE SYMBOLS

Sample MRM attack mode displays are shown in figure 1-19. In the referenced displays, only convenient values are chosen and symbol sizes and locations are not to scale.

Search Display, MRM

In display 1, the pilot has selected the A/A, MRM mode, all scales are ON; the HUD symbol switch is in NORM. In window 2, the M 4 cue shows 4 usable (tuned) MRMs aboard. With master arm in SAFE, the gun cross is OFF.

MRM REFERENCE CIRCLE

With the radar in search, a fixed 12° MRM reference circle is displayed coincident with missile boresight and centered about the aircraft symbol. The purpose of the 12° circle is to provide an immediate steering reference in the event the pilot must visually launch an MRM without radar acquiring the target. (See Radar Set, Flood Mode.)

Track Display, MRM

In display 2 (figure 1-19) the pilot has achieved radar lockon. The reference circle of display 1 is removed and the allowable steering error (ASE) circle, the steering dot, the radar range scale, and the target designator appear on the HUD display. The ASE circle remains centered about the aircraft symbol. Also in display 2, the symbol REJ mode is selected and the master arm switch is in ARM (gun cross ON).

ASE CIRCLE AND STEERING DOT, MRM

The ASE circle and steering dot relate lead angle error (LAE). The pilot steers toward the dot to get the dot in the ASE circle for missile launch. The symbols provide lead collision steering for the MRM attack. The ASE circle and steering dot will flash when the antenna LOS reaches a 50° displacement from radar boresight.

As the aircraft closes with a target (from beyond Rmax to Rmin), the ASE circle varies in diameter. As range closes, the circle increases in size until range reaches approximately 0.75 (Rmax 1). Then the circle remains a fixed size until reaching approximately 0.25 (Rmax 1 – Rmin). At this point, the ASE may begin to decrease or increase depending on the attack aspect angle. At a fixed range close to Rmin, the CC delivers the ACM (Air Combat Maneuvering) command which increases the ASE to its maximum size. When this occurs, the attack display is based on pursuit course steering, rather than lead collision steering. The ACS relays the ACM signal (dogfight command) to the AIM-7 which influences missile guidance response and fuze arming time. If a launch is in progress (launch signal has been applied) the ACS will not apply the ACM signal to the missile.

RANGE SCALE AND Rmax/Rmin

When lockon occurs, the range scale appears (display 2, figure 1-19). The uppermost number on the scale is the present selected radar range. The scale is fixed, and the caret moves to indicate target range. Adjacent to the caret is the window No. 1 readout of range rate, which in this case shows a 351-knot closing rate. Along the right side of the range scale are two Rmax indicators (Rmax 1 and Rmax 2) and an Rmin indicator. The Rmax 1 symbol denotes the maximum launch range computed from the aerodynamic range of the AIM-7F missile against a nonmaneuvering target. The Rmax 2 symbol is computed for a target evasive maneuver at the terminal phase of missile flight. The Rmin symbol is computed from the minimum time-of-flight required for missile guidance and arming. Refer to TO 1F-15C-34-1-1-1 for MRM launch envelopes.

HUD DISPLAYS, MRM STEERING

(AFTER TO 1F-15-618)

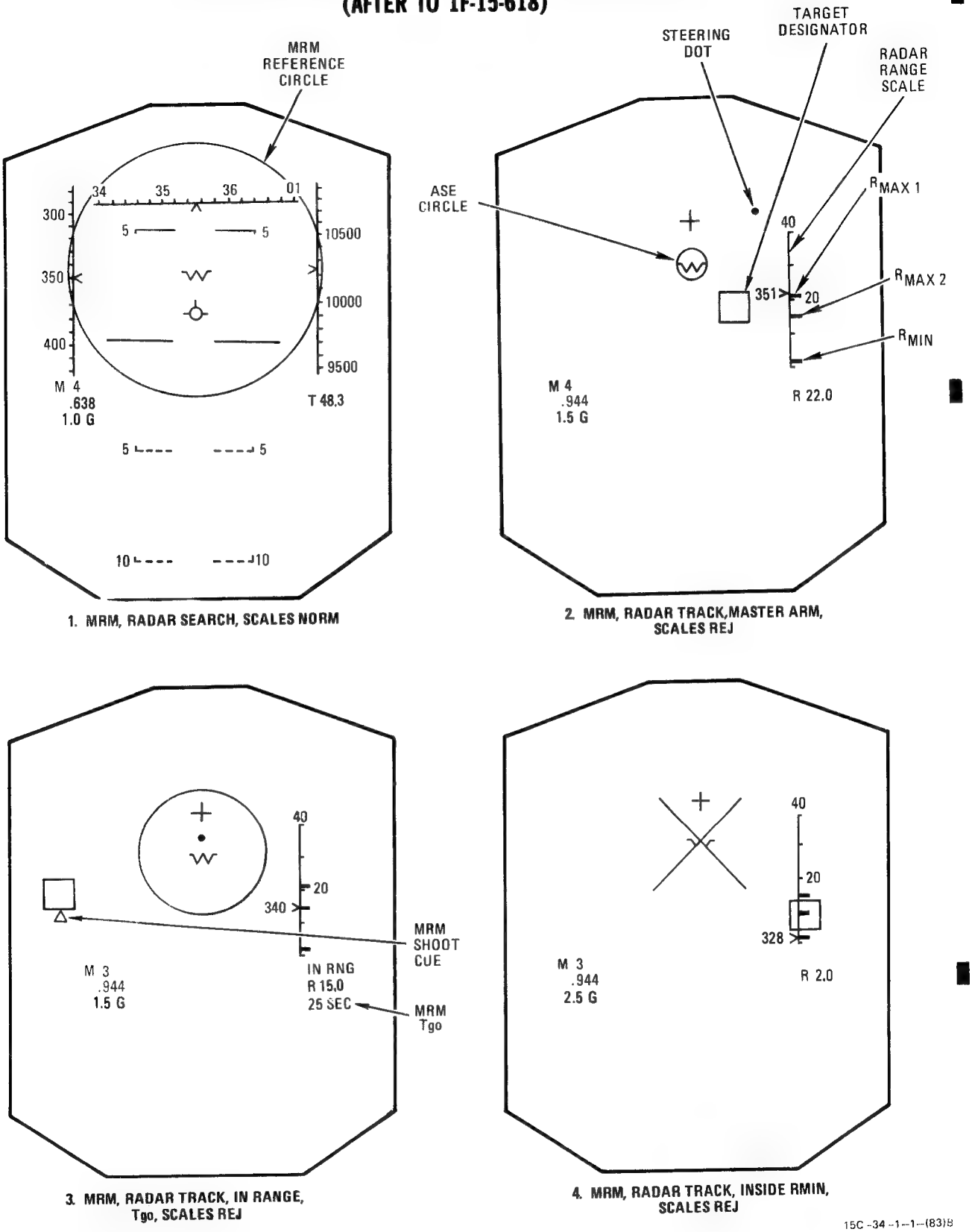


Figure 1–19

TARGET DESIGNATOR

The target designator (TD) is displayed when the radar is angle tracking a target (display 2). The symbol forms a 25-mil square which indicates the antenna line-of-sight (LOS) to the target. When the LOS to target is such that the TD reaches the HUD FOV limit, the symbol flashes.

MRM IN RANGE/Tgo

The IN RNG cue is displayed as a flashing symbol when target range is anywhere between Rmax 1 and Rmax 2; and as a steady symbol between Rmax 2 and Rmin (display 3). The Tgo cue (MRM predicted time of flight) is displayed and continuously updated while range is between Rmax 1 and Rmin. If the pilot launches an MRM, the missile quantity count changes and the missile Tgo cue starts flashing and begins countdown. If more than one missile is launched, the Tgo countdown is based on the last missile fired.

MRM SHOOT CUE

The AIM-7F shoot cue (triangular symbol) is displayed below the TD symbol (display 3, figure 1-19) when the following launch conditions exist. The shoot cue appears above the TD symbol when the TD symbol is limited to the lower half of the HUD field of view where the cue would not be visible. (The lock/shoot lights start flashing when the shoot cue is displayed.)

a. Mode selected — MRM
b. Master arm switch — ARM
c. Radar — HIGH PRF (Final Track)
d. After TO 1F-15-618, steering dot inside ASE circle.
e. Target range between Rmax 1 and Rmin. (Shoot cue will flash between Rmax 1 and Rmax 2).
f. IN RNG cue — DISPLAYED (window 3)

MRM BREAKAWAY

In display 4 (figure 1-19), range has decreased to Rmin. At Rmin, the break X symbol is displayed and the ASE circle and steering dot go OFF. The break X is a steady symbol while a missile is inflight (Tgo has not reached zero), and a flashing symbol at all other times.

HUD SRM MODE SYMBOLS

Search Display, AIM-9J/P

In display 1, (figure 1-20), the S4 cue indicates 4 missiles aboard and all missiles either in a STBY or RDY status.

After TO 1F-15-618, S4 indicates that the CC is computing for AIM-9J-2/-3/P-2/-3 missiles. If AIM-9J/J-1/P/P-1 missiles are aboard, an S4J indication must be obtained by placing the NCI data select knob to CCC and pressing the UPDATE button. Pressing the UPDATE button again will return to the S4 indication.

SRM FOV CIRCLE

The 2° reference circle around the aircraft symbol indicates the SRM seeker head caged position, 44 mils below the gun cross.

Track Display, AIM-9J/P

With radar track established (display 2), the display includes the TD , the radar range scale with Rmax/Rmin markers, and the target opening or closing rate in window 1. The 2^{o} reference circle remains on the track display, fixed in size and location. The reference circle and the TD symbol provide the ASE relationship. The pilot steers to get the TD positioned within the reference circle, and closes with the target to get SRM tone acquisition. With the tone ON, the pilot may initiate uncage to attempt seeker lockon or launch immediately. The Rmax indicator shows that launch range from which the SRM can reach the target with enough energy remaining to pursue if the target begins evasive action.

Seeker Uncage, AIM-9J/P

When the nose gear steering button is momentarily pressed, the priority SRM seeker head uncages and attempts lockon. The 2^{o} reference circle is removed (display 3, figure 1-20). In this case, the HUD field of view approximates the AIM-9J/P seeker gimbal limits. (Refer to part 2, AIM-9J/P Attack.)

Search Display, AIM-9L

In all displays (figure 1-21), the S4 cue indicates 4 AIM-9 missiles are aboard and all missiles are either in a STBY or RDY status. The outer circle around the aircraft symbc indicates the missile seeker FOV, which varies in size with the SCAN status selected (displays 1 and 2). The small circle inside the FOV circle is the AIM-9L seeker head symbol, which indicates seeker LOS during all attack phases.

SEEKER HEAD POSITION CIRCLE, AIM-9L

The AIM-9L seeker head position circle indicates the LOS of the AIM-9L missile in priority until missile launch. When the seeker position exceeds the HUD FOV, the symbol is displayed as a half-symbol on the edge of the HUD FOV at proper AZ and EL angles.

FOV CIRCLE, AIM-9L

The AIM-9L FOV circle remains centered on the HUD and changes in size depending on the selection of SCAN or non-SCAN. The FOV circle is removed from the HUD display when the AIM-9L seeker is uncaged or when the radar is in angle track.

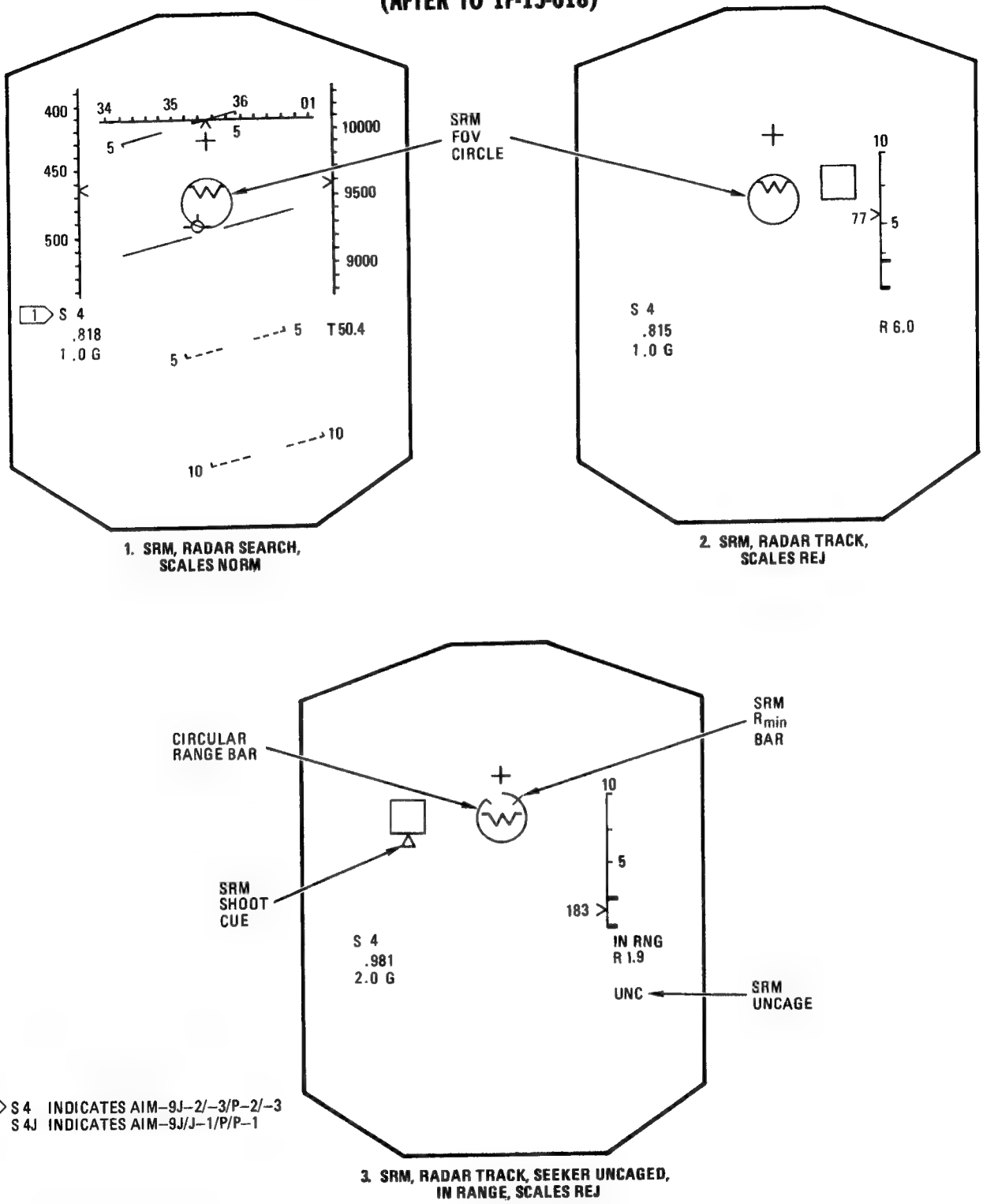
Track Display, AIM-9L

With radar track established (figure 1-21, display 3), the display includes the TD , radar range scale, Rmax and Rmin symbols, range rate readout, SRM seeker position symbol, ASE circle, and steering dot. The seeker position symbol slaves to the TD symbol indicating the priority seeker LOS. The TD symbol is displayed as a half symbol if the target LOS exceeds the HUD FOV.

HUD DISPLAYS, SRM STEERING

AIM-9J/P

(AFTER TO 1F-15-618)



1. SRM, RADAR SEARCH, SCALES NORM

2. SRM, RADAR TRACK, SCALES REJ

3. SRM, RADAR TRACK, SEEKER UNCAGED, IN RANGE, SCALES REJ

1 S 4 INDICATES AIM-9J-2/-3/P-2/-3
S 4J INDICATES AIM-9J/J-1/P/P-1

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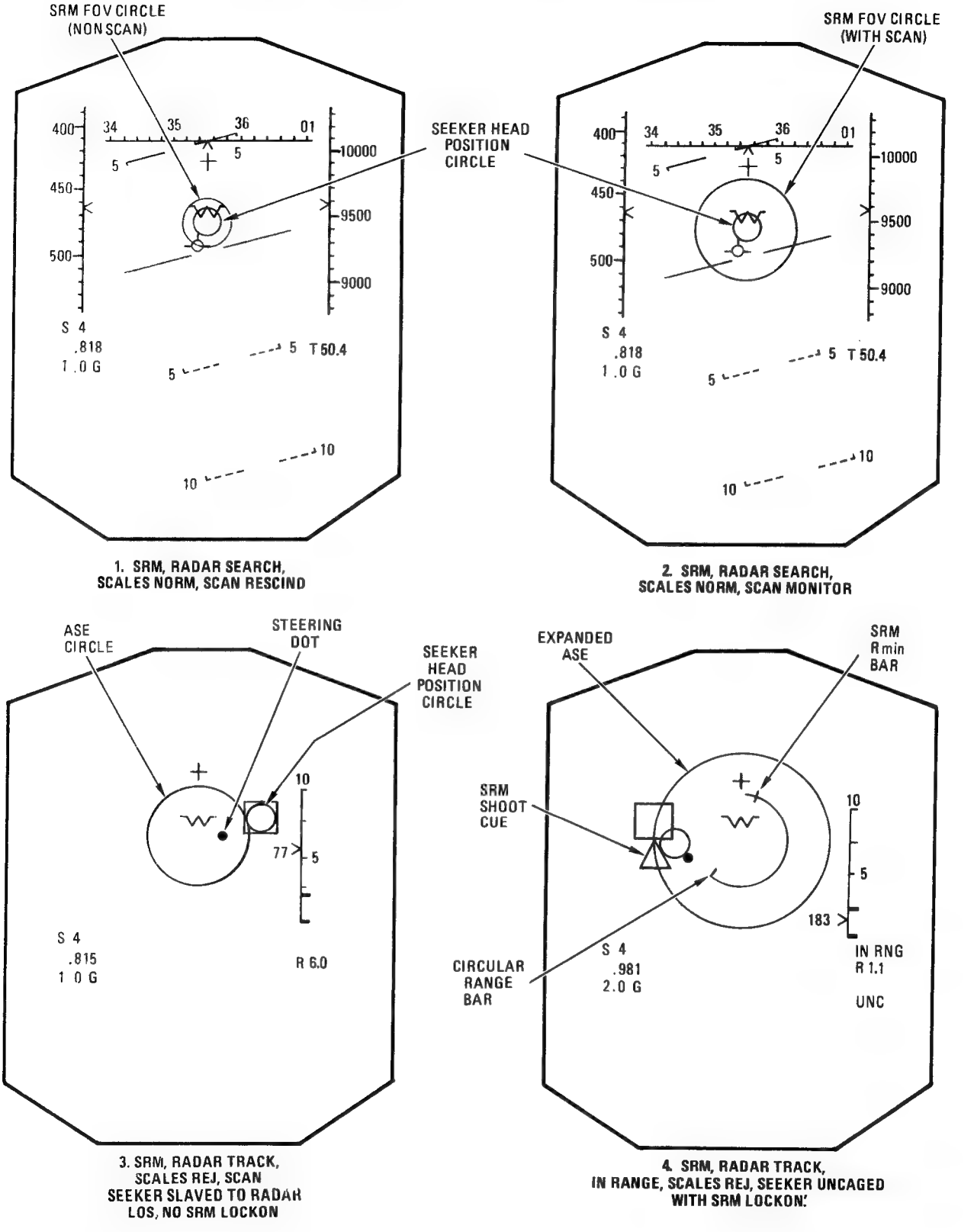
Figure 1-20

HUD DISPLAYS, SRM STEERING

AIM-9L (AFTER TO 1F-15-618)



1. SRM, RADAR SEARCH, SCALES NORM, SCAN RESCIND

2. SRM, RADAR SEARCH, SCALES NORM, SCAN MONITOR

3. SRM, RADAR TRACK, SCALES REJ, SCAN SEEKER SLAVED TO RADAR LOS, NO SRM LOCKON

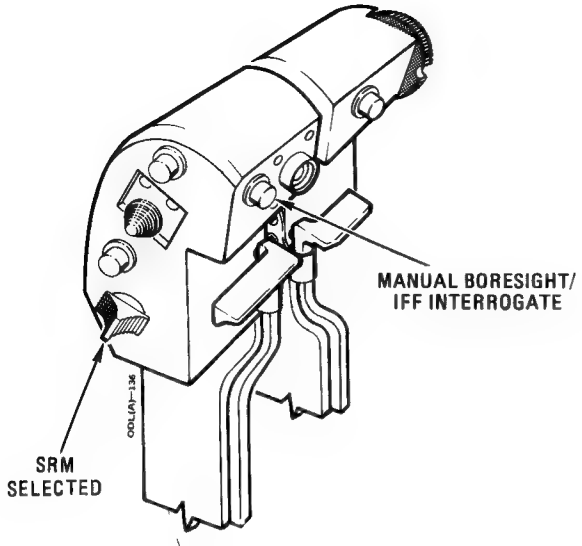
4. SRM, RADAR TRACK, IN RANGE, SCALES REJ, SEEKER UNCAGED WITH SRM LOCKON.

15C-34-1-1-(169-1)B

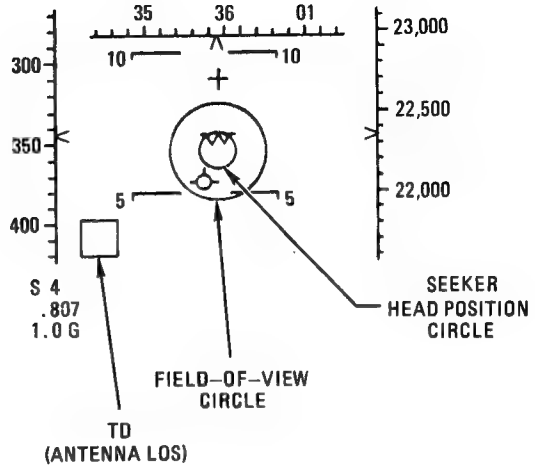
Figure 1-21 (Sheet 1 of 2)

HUD DISPLAYS, SRM STEERING (Continued)

MANUAL BORESIGHT



INHIBITED AIM-9L SYMBOLS
RANGE SCALE
RANGE CARET & RANGE RATE
R_{max} R_{min}
IN RANGE/NO ZONE
SHOOT CUE
RANGE BAR



5. AIM-9L MANUAL BORESIGHT: RADAR TRACK, SCALES NORM, SCAN, IFF BUTTON PRESSED, SEEKER CAGED, NO SRM LOCKON.

15C-34-1-1-(169-2)B

Figure 1-21 (sheet 2)

If seeker lockon is accomplished, the ASE circle doubles in size (figure 1-21, display 4). The seeker head circle and the TD are displayed independently and will likely show 1° or 2° offset. The CC continues to supply pursuit steering indications via the steering dot. An IN RNG (in range) condition is indicated when target range is between the Rmax and Rmin symbols.

ASE CIRCLE AND STEERING DOT

Pursuit steering is provided by the AIM-9L ASE circle and steering dot when the radar is angle tracking. The pilot should fly to center the dot. The ASE circle replaces the FOV circle and remains centered on the HUD. The diameter of the ASE circle doubles to indicate seeker self-track (IR lockon); however, the launch region remains unchanged (Refer to TO 1F-15C-34-1-1-1).

SRM Rmax AND Rmin SYMBOLS

The maximum and minimum AIM-9L missile launch range boundaries are displayed by the Rmax and Rmin symbols when the radar is tracking the target. The symbols are removed during a NO ZONE condition.

SRM RANGE BAR AND Rmin BAR

The circular range bar appears inside the ASE circle when the radar range to target is less than 12,000 feet. The clock position of the end tab indicates the slant range. (The 6 o'clock position is 6000 feet.) SRM Rmin range is repeated on the circular range bar by a short line (Rmin bar) perpendicular to the circle.

SRM SHOOT CUE

The SRM shoot cue (triangular symbol) is displayed below the TD symbol when the following launch conditions exist. (The lock/shoot lights begin flashing.) The shoot cue appears above the TD symbol when the TD is limited to the lower half of the HUD field of view where the cue would not be visible.

a. Mode selected — SRM
b. Master arm switch — ARM
c. Radar — TRACK
d. After TO 1F—15—618, steering dot inside ASE circle.
e. Target range between Rmax and Rmin.
f. (AIM—9L only) Seeker/radar antenna coincidence and ACS audio threshold achieved. With the seeker uncaged, the shoot cue may flash. (Refer to Part 2, AIM—9L attack.)

If the pilot operates with the AIM-9L seeker in BST and nonscan, the shoot cue is not displayed.

Track Display, AIM-9L Manual Boresight

With radar angle track established and SRM selected, the seeker head of the missile in priority is slaved to the radar antenna LOS (figure 1—21, display 3). The pilot can manually boresight the seeker head by holding the IFF button pressed (figure 1—21, display 5) if the seeker is not locked on. If the seeker is locked on, the pilot must break IR lockon by momentarily pressing the nose gear steering button and then holding the IFF button pressed to boresight the seeker head. With the seeker boresighted and the radar antenna tracking a target, the pilot is free to fire an AIM—9L at a second target while continuing to radar-track the first target. The AIM—9L FOV circle flashes when the radar antenna approaches its gimbal limit ($\pm 50^{O}$). The seeker SCAN and UNC functions remain functional in the manual boresight mode, but the shoot cue is not displayed.

SRM Breakaway

The flashing break X symbol appears on the HUD when range closes inside the Rmin indicator.

HUD GUN MODE SYMBOLS

When the pilot selects the gun steering mode (figure 1—22), the symbols unique in the gun display are the gun reticle and the rounds remaining numerics (940) in window 2.

Search Display, Gun Mode

The primary reticle consists of a 50-mil circle, a 25-mil segmented circle, and a 2-mil pipper. Without lockon, the reticle provides lead compute steering for a fixed firing range of 2250 feet. In non-maneuvering flight this places the reticle close to the gun cross. If the pilot presses the reticle stiffen button on the throttle, reticle steering is based on a fixed range input of 1000 feet; e.g., the reticle would move upward toward the gun cross in display 1. The reticle stiffen function is available in both radar search or track modes.

Track Display, Gun Mode

A gun mode track display is shown in display 2, figure 1-22. The radar range scale and TD symbol appear, and the 25-mil reticle circle is removed. The range bar appears and indicates target range in feet. Each tick mark around the 50-mil circle represents 1000 feet to a total of 12,000 feet when the bar is extended clockwise to the 12:00 o'clock position. A 5000-foot range is represented in display 2. The bullet time-of-flight (Tf) cue is displayed at the perimeter of the reticle range bar to indicate the range that corresponds to a bullet Tf of 1.4 seconds or an impact velocity of 500 fps, whichever produces the shortest range.

When the pilot achieves reticle tracking with the pipper on target, the TD symbol and reticle image will be in near coincident positions. The TD symbol is removed when the center of the symbol approaches within 25 mils of the pipper, and target range is less than 3000 feet. The TD symbol reappears when range is greater than 3200 feet or when the center of the TD symbol is more than 35 mils from the pipper. A firing range is reached when the range bar tab reaches the Tf cue. The lag line (display 3) is visible whenever reticle motion results in a tracking error in excess of 3 mils.

The lag line indicates that the damped pipper is not in a solution. The direction of the line indicates the direction (relative to the HUD) that the pipper is moving to get in solution. The sight is in solution when the lag line disappears. A solution can occur only if the aircraft is at a constant load factor.

In display 4, the standby reticle is shown at 44 mils depression. The standby reticle cannot be placed in a lead compute mode; the reticle can only be depressed in

HUD DISPLAYS, GUN MODE STEERING

(AFTER TO 1F-15-618)

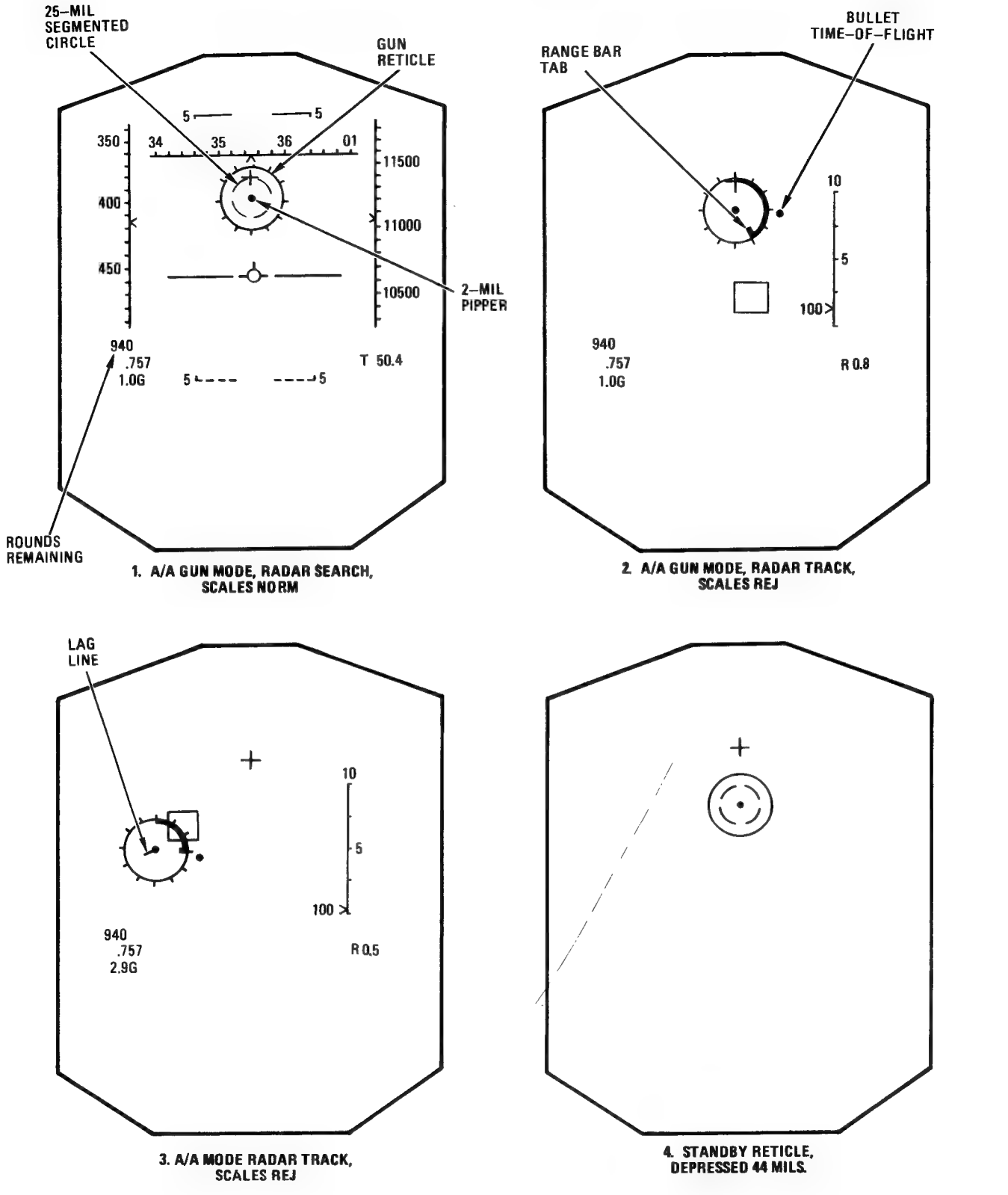


Figure 1–22

elevation using the reticle depression control. In an A/A gun mode, the only way the primary reticle can be depressed is in the event the LCG fails. In this case, the primary reticle assumes the same function as the standby reticle.

HUD DISPLAYS, VI STEERING

The vis—ident (VI) mode is selected by pressing the VI master mode button with the throttle weapon switch in MRM or SRM. The radar must be in angle track for VI steering to be provided on the displays. The ASE circle and steering dot provide steering information to bring the aircraft behind the target, slightly below and to the right, and on target heading. The steering computed by the CC is a function of target horizontal aspect angle. For nose aspect angles greater than 135°, the mechanization provides a constant 30° lag angle pursuit steering program (before TO 1F—15—618). The lag angle decreases for aspect angles from 135° to 90°. For target aspect angles less than 90°, the steering is pure pursuit referenced to a point 200 feet below and to the right of the target.

After TO 1F—15—618, the CC will compute nose aspect lag angle steering as a function of F—15 velocity and target range. Instead of a constant 30°, the lag angle used will vary from 15° to 45° to avoid excessive lateral offset or high—G maneuvering during conversion steering (figure 1—23).

The VI display (figure 1-24) does not contain Rmax or Rmin symbols, but does include a target Mach (TM) readout which is displayed in HUD window 8. The ASE circle has a fixed diameter of 18° until 1.25 NM range (7600 feet) where the circle decreases linearly to a minimum of 6° at 2533 feet. A flashing break X is displayed at 1500 feet or 30 seconds from collision range, whichever is greater. When the break X appears, the ASE circle and the steering dot remain on the display. A circular range bar appears on the HUD when radar range is less than 12,000 feet. The clock position of the end tab indicates radar range to the target: the 6 o'clock position is 6000 feet.

HUD DISPLAYS, AUTOMATIC ACQUISITION MODE STEERING

The HUD displays obtained in the automatic acquisition modes are shown in figure 1—25. The AIM—9J/P or AIM—9L reference circle is displayed in supersearch, boresight and vertical scan when SRM is selected except when the priority missile is uncaged.

The 20° supersearch reference circle is obtained in the supersearch mode. The 4° boresight reference circle is obtained in the boresight mode. The heading scale is removed from the supersearch and boresight modes. The vertical scan reference line is displayed when the vertical scan mode is selected. The auto gun scan display is the same as A/A gun mode, radar search display.

HUD SUMMARY

Figure 1-26 provides a listing of most tactical HUD symbols and the avionics master modes in which they can be displayed. Air-to-ground HUD data is described in TO 1F-15C-34-1-2.

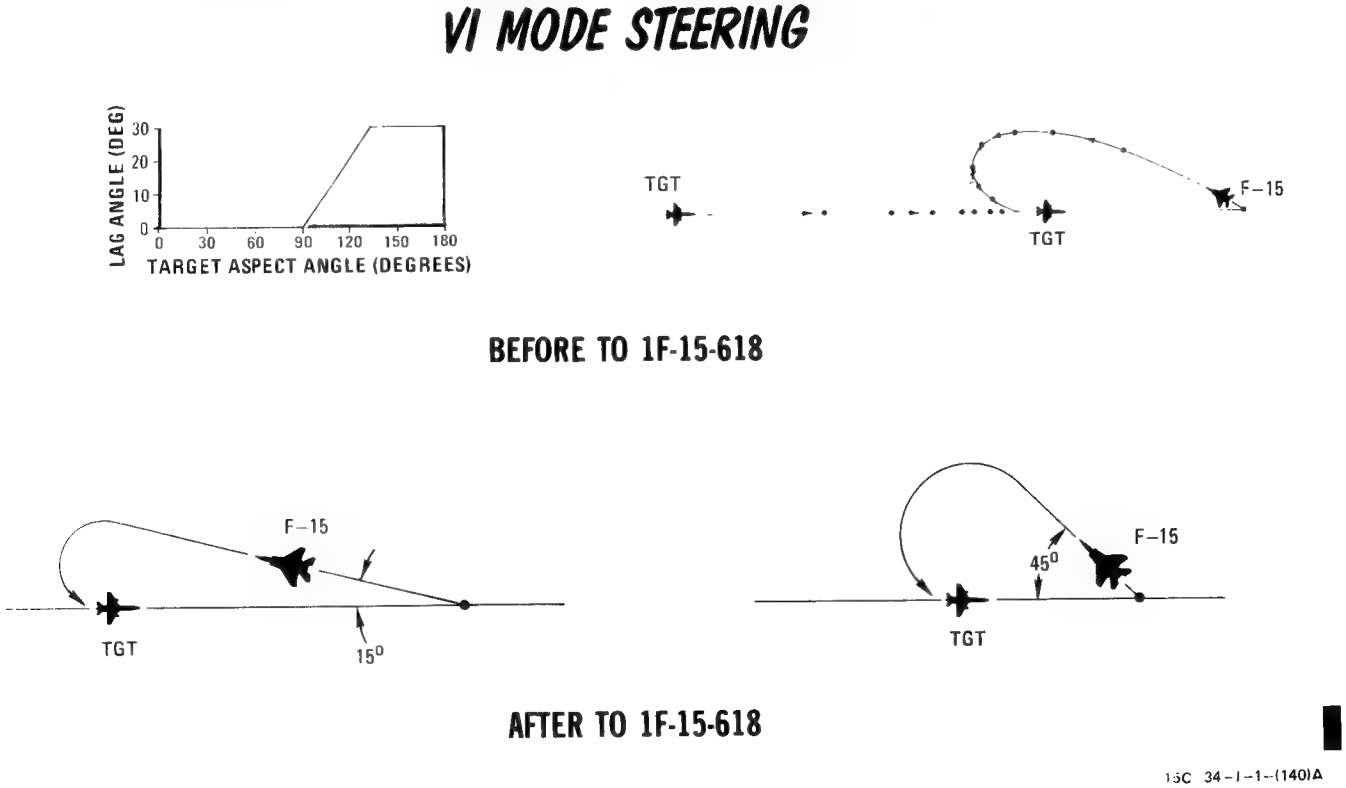
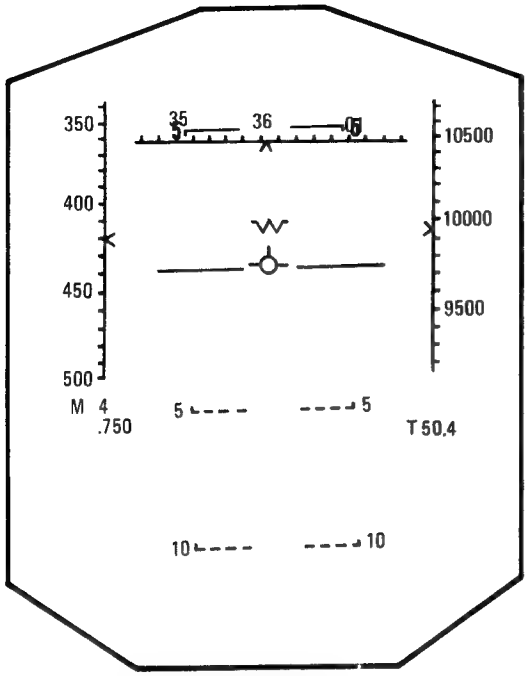


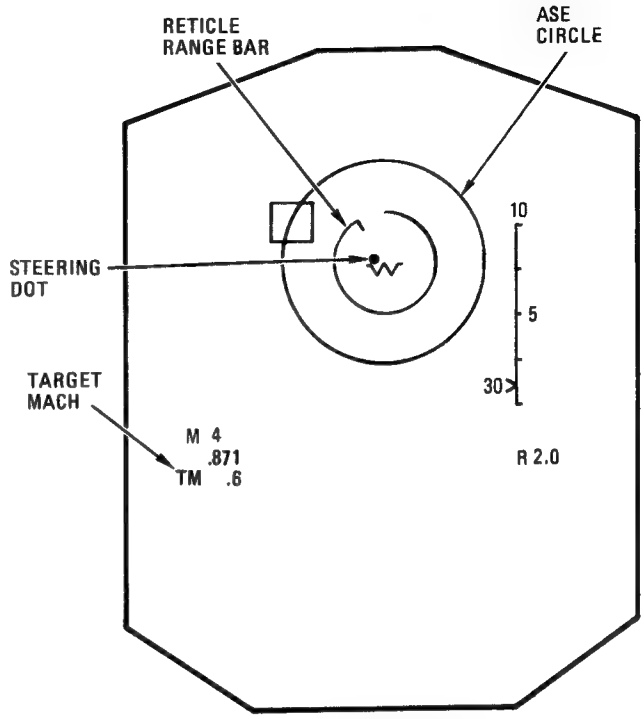
Figure 1-23

HUD DISPLAYS, VIS-IDENT STEERING

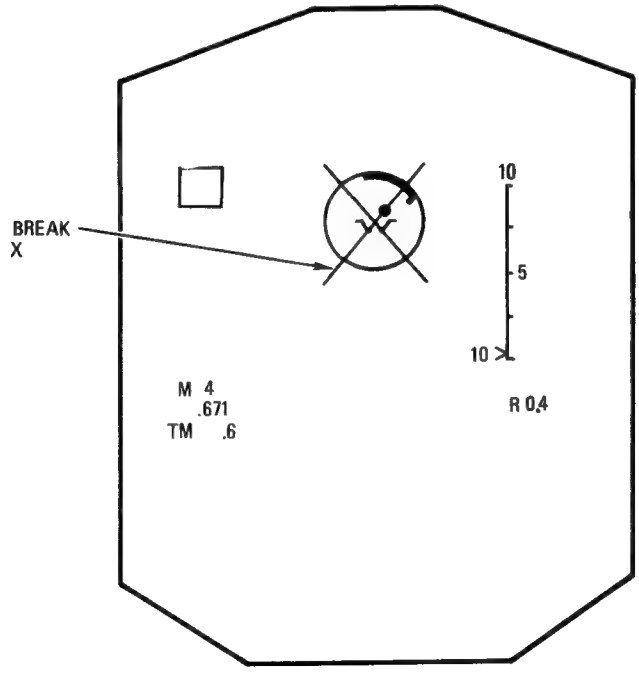
(AFTER TO 1F-15-618)



1. VI MODE, MRM, RADAR SEARCH, SCALES NORM



2. VI MODE, MRM, RADAR TRACK, SCALES REJ



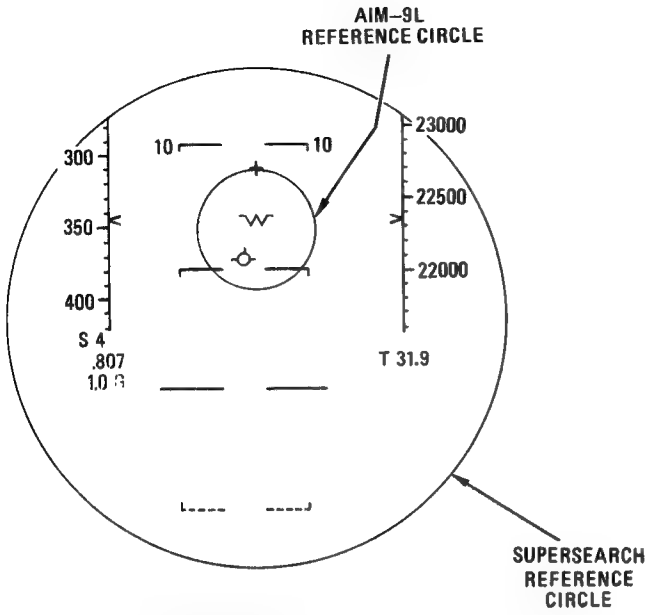
3. VI MODE, MRM, BREAK X RANGE

15C-34-1-1-(84)B

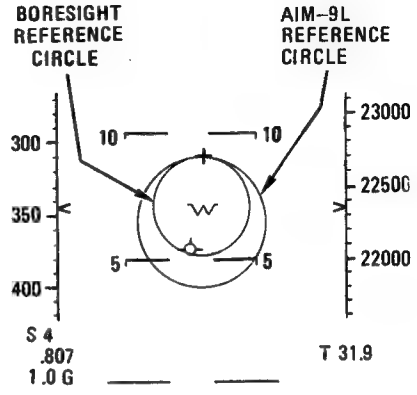
Figure 1–24

HUD DISPLAYS, AUTOMATIC ACQUISITION MODES

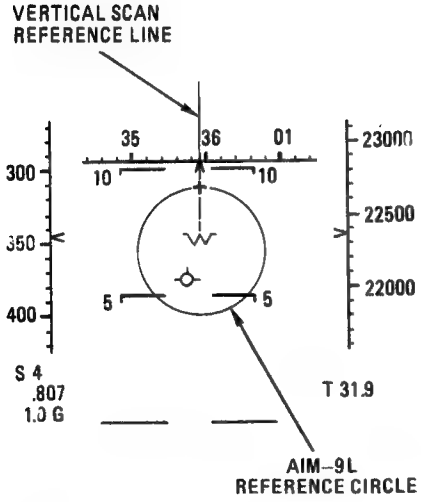
(AFTER TO 1F-15-618)



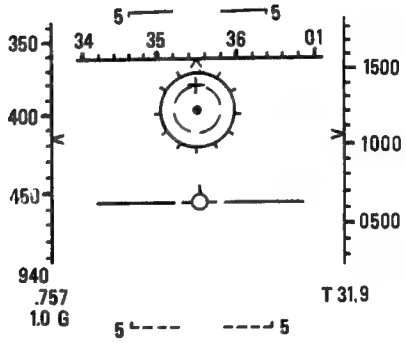
1. SUPERSEARCH (SS), SRM SELECTED.



2. BORESIGHT (BST), SRM SELECTED.



3. VERTICAL SCAN, SRM SELECTED.



4. AUTO GUN SCAN, GUN SELECTED.

15C-34-1-1-(167)A

Figure 1-25

HUD SYMBOLOGY SUMMARY
(BEFORE TO 1F-15-618)

SYMBOL / MODE	A/A MODE				VI	A/G MODE				ADI MODE				ALL MODES	
	MRM (AIM-7F)	SRM (AIM-9J/P)	GUN	SRM (AIM-9L)	VIS-IDENT	AUTO	CDIP	DIRECT/MANUAL	GUIDED WEAPON (EO)	NAV	TACAN	ILS-NAV	ILS-TCN	CC NO-GO	SYMBOLS REJECT
WINDOW 1:															
RANGE RATE	X	X	X	X	X										
WINDOW 2:															
ROUNDS REMAINING			X												
MISSILE COUNT	X	X		X											
ILS MARKER												X	X		
WINDOW 3: 1															
IN RANGE	X	X		X											
NO ZONE	X	X		X											
RADAR SPECIAL MODES	X	X	X	X	X										
NAV										X					
TCN											X				
ILS-N												X			
ILS-T													X		
WINDOW 4: 1															
MEM	X	X	X	X	X										
JAM CODES	X	X	X	X	X										
NAV DEST., MK. TGT						X	X	X	X	X		X			
RADAR RANGE	X	X	X	X	X										
WINDOW 5: 1															
HOLD ALT	X														
A/G TIME-TO-GO						X	X								
MISSILE TIME-TO-GO	X														
TACAN RANGE	X	X	X	X	X										
ADI RANGE										X	X	X	X		
WINDOW 6:															
COURSE SET												X	X		
GLIDESLOPE WARNING												X	X		
UNC		X		X											
RAM	X	X	X	X	X										
WINDOW 7:															
MACH NO.	X	X	X	X	X										

1 SEE HUD WINDOW DISPLAYS FOR AFTER TO 1F-15-618 CONDITION

15C-34-1-1-(130-1)D

Figure 1-26 (Sheet 1 of 2)

HUD SYMBOLOGY SUMMARY (*Continued*)

SYMBOL \ MODE	A/A MODE				VI	A/G MODE				ADI MODE				ALL MODES	
	MRM (AIM-7F)	SRM (AIM-9J/J-1/P/P-1)	GUN	SRM (AIM-9L)	VIS-IDENT	AUTO	CDIP	DIRECT/MANUAL	GUIDED WEAPON (EO)	NAV	TACAN	ILS-NAV	ILS-TCN	CC NO-GO	SYMBOLS REJECT
WINDOW 8:															
TGT MACH					X										
AIRCRAFT G	X	X	X	X		X	X	X	X	X	X	X	X		
SHOOT CUE	X	X		X											
PITCH STEERING												X	X		
BANK STEERING										X	X	X	X		
AIRCRAFT SYMBOL	X	X		X	X					X	X	X	X	X	
VELOCITY VECTOR	X	X	X	X	X	X	X	X	X	X	X	X	X		(X)
AZIMUTH STEERING LINE						X	X								
DISPLAYED IMPACT LINE							X								
ALTITUDE SCALE	X	X	X	X	X	X	X	X	X	X	X	X	X		X
AIRSPEED SCALE	X	X	X	X	X	X	X	X	X	X	X	X	X		X
HEADING SCALE	X	X	X	X	X	X	X	X	X	X	X	X	X		X
COMMAND HEADING						X	X	X	X						
AOA SCALE										X	X	X	X		X
PITCH SCALE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
RANGE SCALE	X	X	X	X	X										
GUN CROSS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
R_{MIN}, $R_{MAX\ 1}$	X	X		X											
$R_{MAX\ 2}$	X														
ASE CIRCLE	X	X		X	X										
RETICLE RANGE BAR		X	X	X	X	X	X	X	X					X	
A/A RETICLE			X											X	
LAG LINE			X												
A/G RETICLE						X	X	X	X						
BULLET TIME-OF-FLIGHT			X												
STEERING DOT	X			X	X										
RELEASE CUE						X	X								
PULL-UP CUE						X	X								
A/A TGT DESIGNATOR	X	X	X	X	X										
A/G DESIGNATOR						X	X	X	X						
BREAKAWAY CUE	X	X		X	X										
FOV/REF CIRCLE	X	X		X											
SRM SEEKER POSITION		X		X											
VERT SCAN LINE	X	X	X	X	X										
SUPER SEARCH CIRCLE	X	X	X	X	X										

(X) REJECT IN A/A MODE ONLY

15C-34-1-1-(130-2)A

Figure 1-26 (Sheet 2)

VERTICAL SITUATION DISPLAY (VSD)

The VSD provides tactical situation displays for all radar modes. The type of display available for the indicator is a function of the operating master mode of the aircraft and the munition selected.

VSD CONTROLS

VIDEO BRIGHTNESS/CONTRAST

In F-15D aircraft, rear cockpit VSD controls are independently functional only if the front cockpit BRT knob is ON.

BRIGHT (BRT) KNOB

OFF	The VSD system is deenergized.
ON	Energizes the VSD system and adjusts the brightness of nonsymbolized video displayed in MAP radar modes.

CONTRAST (CONT) KNOB

The CONT knob adjusts the contrast level of the nonsymbolized radar video displayed in the PULSE or MAP radar modes.

SYMBOL BRIGHTNESS (SYM BRT) KNOB

The SYM BRT knob adjusts the brightness level of all VSD symbols.

RADAR (RDR) KNOB

The RDR knob adjusts radar video gain only in the MAP radar mode.

CONTRAST (CONT) SWITCH

MAN	Changes in VSD display brightness must be accomplished manually.
AUTO	Changes in ambient light cause a display brightness change to maintain a constant contrast between symbol/video brightness and background brightness. This (AUTO) function is disabled in F-15C-24 and up aircraft by the installation of the video tape recording (VTR) system. In F-15D aircraft, AUTO/brightness is functional in all aircraft.

VSD DISPLAY SYMBOLS

VSD WINDOW DISPLAYS

The location of the VSD windows is illustrated in figure 1-27. Windows 1 thru 4 are CC controlled; the BIT and range scale windows are radar controlled. Several symbol items are repeated on the HUD display as described in preceding paragraphs.

VSD Window 1

TRACK MEMORY (MEM)

The MEM cue indicates that the radar has entered the track memory (or track-extrapolate) mode. After a signal loss of 3 seconds, MEM is displayed and the radar track-extrapolates (for 3 seconds) the last known target position and velocity. Then the radar enters a reacquisition sequence for up to 6 seconds. If a signal return is received any time during this sequence, the radar re-enters normal track. If not, the radar returns to search. If MEM comes ON after an MRM launch, the radar track-extrapolates until 15 seconds after missile Tgo is zero. Refer to part 2, Radar Employment, for additional information.

JAM CODES (JAM, HOJ, AOJ)

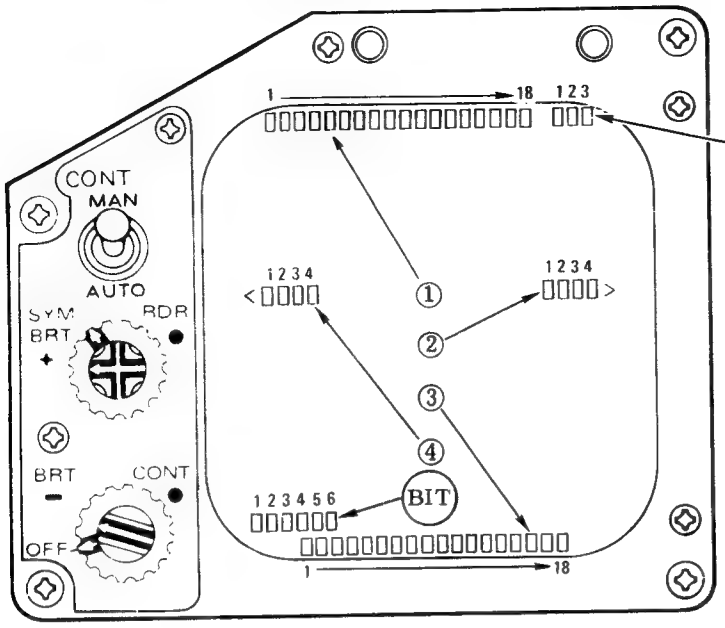
The jam codes are displayed when jamming conditions are detected in any A/A or VI mode. Refer to TO 1F-15C-34-1-1-1.

ALTITUDE COVERAGE

The altitude coverage numerics show the maximum and minimum scan altitudes (MSL, feet X 1000) which the radar is covering at the acquisition symbol range. Both numbers can be positive or negative since the values are a function of the throttle elevation control setting, EL bar setting, aircraft altitude, and acquisition symbol range on the VSD. The cues are displayed when the radar is being operated in any A/A search mode.

VSD CONTROLS / WINDOW DISPLAYS

(AFTER TO 1F-15-606)



WINDOW① 1 5 10 14 18 — MEM — Track Memory; JAM / AOJ / HOJ — Radar Jam Codes

3 10 14 — MN TK / SNIFF / FLOOD — Radar Special Modes

1 7 — 10 28 — Min/Max Scan Altitude (MSL)

Target Speed, G, Aspect Angle ⟨1⟩

1 5 10 — 1075 3 10R — L / H / T

Target Speed, MAG HDG, Aspect Angle, G ⟨2⟩

1 5 10 14 — 1075 240 10R 3 — L / H / T

16 18 — 4 – 5 — RAM Scan Azimuth Coverage (NM)

1 5 — STBY / TUNE — Radar Operating Cues

WINDOW② 1 5 — 1300 — Range Rate (A/A or VI Track) Acq. Symbol velocity, VS Mode

⟨1⟩ Before TO 1F-15-618
⟨2⟩ After TO 1F-15-618
⟨3⟩ Deleted After TO 1F-15-606

WINDOW③ 1 5 10 14 18 — G1000 T1000 — Ground Speed (G) / True Air - Speed (T)

7 12 — 29 SEC — MRM Tgo
HD ALT — Hold Altitude
IN RNG — SRM Only
NO ZN — No Zone

1 5 — 26 NM — Priority Tgt Range (RAM

1 4 — WINDOW④ 15-5 — Target Alt. (MSL)

BIT WINDOW 1 6 — 4 — Current Bar Scan

HI / MED / LO — Radar PRF

RF NG — Radar Transmitter Power Low
FS2 — Frame Store Selected (BCN modes only)
CHAN 3 — Channel Selected (Sniff only)
I — AAI Interrogate
FLO LO — Transmitter Coolant & Press.
RDR HOT — Insufficient Cooling Air To Radar Data Processor

RAM — RAM Track
RAM-A — RAM Relative Altitude
NO RAM
PSP LD — Operating Mode Change

15C-34-1-1-(92)C

Figure 1-27

In RAM track, the azimuth coverage of the scan pattern (at the designated area) is displayed at the extreme right side of window 1. The value shown is 4.5 NM.

TRACK DATA

The track data is presented in MRM, SRM and gun A/A modes with the radar in full radar track. Track data includes the approximate target true airspeed in knots, target load factor to the nearest G, and target aspect angle (figure 1-28).

After TO 1F-15-618, target magnetic heading to the nearest 10° is displayed to help the pilot correlate the radar target to a GCI target.

RADAR OPERATING CUES

STBY	Displayed when STBY is selected on the radar power knob. If the radar power knob is moved from OFF directly to OPR, STBY is displayed for 3 minutes.
TUNE	Displayed when radar OPR is first selected (after 3-minute STBY). The cue remains ON until all missiles TUNE or for a maximum of 2 minutes. Normally, the missiles tune in about 5 seconds; the ACP MRM status windows show STBY and the TUNE cue goes OFF. If a missile does not tune, it is automatically dropped from the firing order. If no missiles are aboard, the cue appears for 5 seconds, then goes OFF.

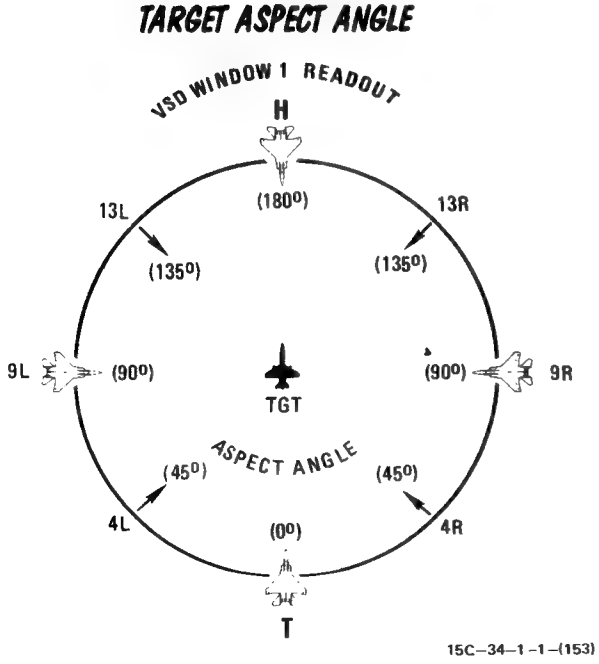


Figure 1-28

RADAR SPECIAL MODES

When the radar is operating in a special mode, the operating mode is announced: FLOOD, SNIFF, or MN TK (manual track mode).

VSD Window 2

Window 2 displays the opening or closing rate (KTS) between the aircraft and the target when the radar is in A/A or VI range track.

In the VS radar mode, a velocity readout is presented in window 2 which represents the velocity position of the acquisition symbol on the VSD. The symbol is also displayed during the manual track mode with velocity search selected.

VSD Window 3

GROUND SPEED/TRUE AIRSPEED

In window 3, the ground speed and true airspeed readouts are displayed in any operational mode except EO.

RAM RANGE DISPLAY

When the radar enters the RAM mode, the designated target range is displayed in place of ground speed.

MRM TIME-TO-GO (Tgo)

Tgo is an MRM time of flight cue displayed when target range is between Rmax 1 and Rmin. At launch, the cue flashes and begins countdown to zero (missile impact) for the last missile fired. (Refer to HUD window 5 for the after TO 1F-15-618 Tgo mechanization.)

HOLD ALTITUDE (HD ALT)

In radar track, this cue indicates that the MRM attack geometry requires the pilot to maintain present altitude. A snap-up maneuver is flown when the cue goes OFF.

IN RANGE (IN RNG)

The IN RNG cue appears in the SRM mode when target range is between Rmax and Rmin.

NO ZONE (NO ZN)

In radar track (MRM or SRM mode), NO ZN appears when Rmax is less than Rmin. The cue may also appear as a result of erroneous target track information or erratic antenna motion. Refer to AIM-7F Missile, TO 1F-15C-34-1-1-1.

VSD Window 4

With the radar in STT or in RAM track, the cue indicates target altitude (MSL) in thousands and hundreds of feet (15-5 means 15,500 feet MSL).

VSD BIT Window

BAR SCAN

In any A/A search mode, the current bar in the EL scan pattern is indicated by a single digit readout (1 thru 8).

RADAR PRF (HI, MED, LO)

In any A/A search or track mode, the transmitted radar PRF is indicated.

RF NO-GO (RF NG)

This cue is displayed any time the radar transmitter power is below nominal in a normal transmitting period.

FRAME STORE SELECT

In beacon modes, the frame store number selected on the radar panel is displayed as a single digit (1 through 7) preceded by FS. The maximum display is FS 3 in PSP aircraft.

CHANNEL SELECT

During the passive portion of the radar SNIFF mode, the channel presently selected on the radar panel is displayed by a single character (1 through 6 or A) preceded by CHAN (figure 1-27).

FLOW LOW

A FLO LO indication during the 3-minute radar time-out means that the transmitter coolant pressure is insufficient. If this occurs, the transmitter is not operable (radar will not enter the OPR mode).

AAI INTERROGATE

When the pilot initiates an AAI challenge (in a radar compatible mode), the symbol I appears in the BIT window during the challenge period.

RADAR HOT (RDR HOT)

A RDR HOT indication is flashed in the VSD BIT window when insufficient cooling is being provided to the radar data processor. The radar overheat protection sensor will automatically shut down radar power if over temperature or low cooling air flow occurs during ground operation.

RAM CUES

The RAM track, RAM-A, or NO RAM cues indicate the RAM status achieved. The NO RAM cue is displayed for approximately 5 seconds.

PSP LD (After TO 1F-15-606)

The PSP LD indication momentarily appears anytime the pilot changes from an A/A radar mode to and A/G mode or the reverse. This is a normal occurence which indicates that the selected mode is being updated.

VSD SYMBOLS

The symbols displayed on the indicator during an A/A operating mode are shown in figure 1-29. The typical search and track displays in figure 1-29 show how the window symbol information is positioned around the VSD.

Antenna Elevation Scale

The numerals (3) on the scale indicate $\pm 30°$ of radar antenna elevation angle. An additional 30° exists along the unmarked portion of the scale for a total of $\pm 60°$ antenna elevation.

Antenna Elevation Caret

The caret moves vertically along the antenna elevation scale. In search, the caret indicates antenna elevation angle with respect to the horizon. In track, the caret indicates the elevation angle of the target with respect to the horizon.

Grid Lines

The grid lines are range (or velocity) and azimuth references. The vertical spacing between horizontal lines represents one-quarter of the selected range. In velocity search, each space represents 750 fps (approximately 450 knots) of target relative ground speed. The horizontal spacing between each vertical grid line represents 30° in azimuth (3.25° in RAM).

Targets

The various symbols used in the display of radar targets are shown in the upper part of figure 1-29. If an IFF target response corresponds in range and azimuth to a radar target, the rectangular symbol is replaced by a diamond or circular symbol. Refer to Air-To-Air Interrogator Set, part 5. In PSP aircraft, PULSE targets are displayed in symbol (rectangular) form.

Acquisition Symbol

This symbol is displayed in all search modes to enable manual target designation. In PSP aircraft, the symbols remain on the RAM track display to enable designation of another target.

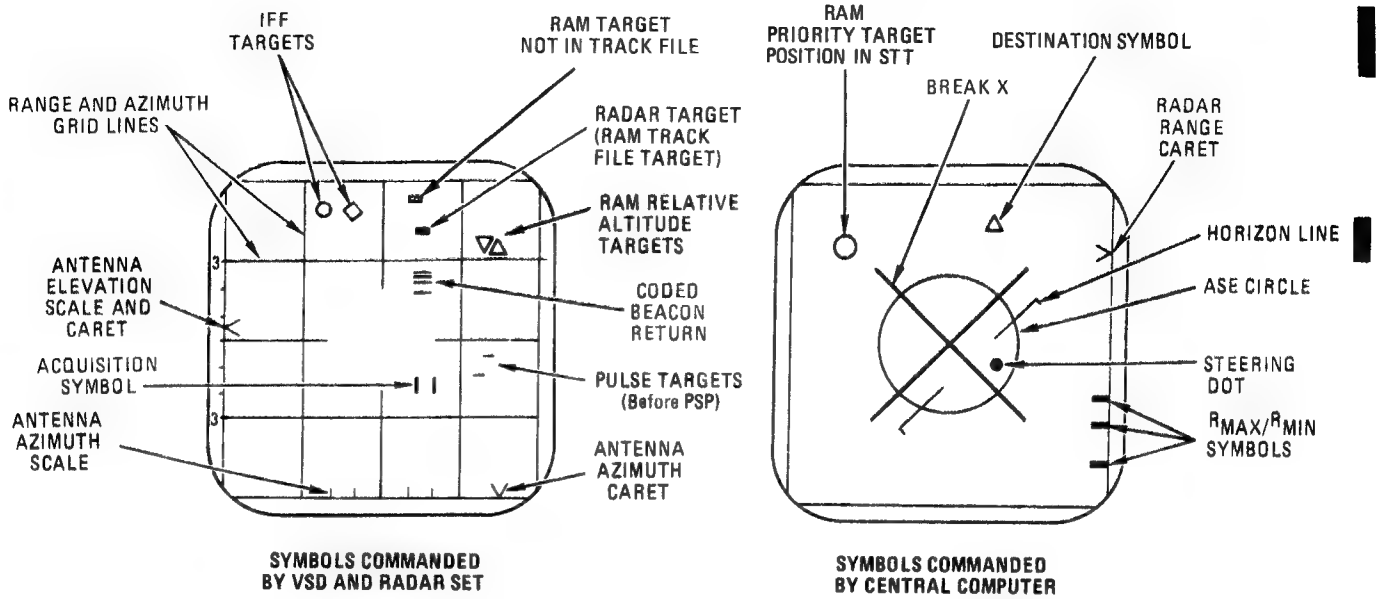
Antenna Azimuth Caret

In search mode, the antenna azimuth caret indicates the current antenna scan position. At lockon, the caret indicates the azimuth angle of the target.

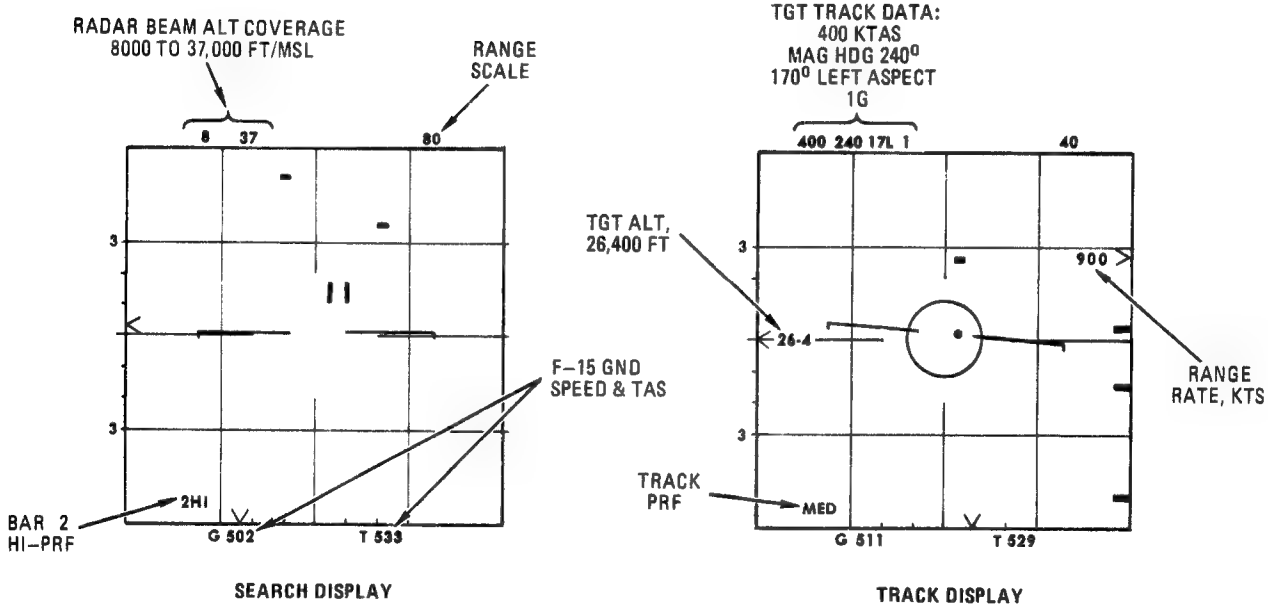
Radar Range Caret

The range caret displays target range. The range rate readout remains adjacent to the range caret.

VSD SYMBOLS, A/A MODES



TYPICAL DISPLAYS



15C-34-1-1-(99)C

Figure 1-29

ASE Circle/Steering Dot

The allowable steering error (ASE) circle is displayed after radar lockon. In MRM, the ASE circle remains fixed at missile boresight, and the circle size varies with range and aspect angle. Centering the steering dot initially provides lead collision steering, then lead pursuit steering if the pilot closes to ACM range.

In AIM-9J/P SRM, a small ASE circle is displayed in the center of the VSD corresponding to the SRM seeker position. In AIM-9L SRM operation, a large ASE circle, representing the steering and launch region, is displayed. For any AIM-9 missile, the steering dot provides pursuit course steering. In the AIM-9J/P SRM mode, the seeker uncage command removes the small ASE circle, and only the steering dot remains.

In gun mode, the ASE circle size corresponds to the HUD field of view. Centering the steering dot provides pursuit course steering to the target.

In SRM, MRM, or VI modes, the ASE circle and steering dot flash when the radar antenna reaches the 50° gimbal limit.

After TO 1F-15-618, the symbols will flash (under the same conditions) in the GUN mode.

Destination Symbol

The destination (triangular) symbol is displayed on the VSD when the steer-to coordinates are within the range and azimuth limit of the VSD. The center of the symbol indicates the steer-to coordinates entered on the NCI panel. The symbol is displayed in A/A and VI radar modes with the radar operating in LRS or SRS, and for all radar range scale selections. The symbol is not displayed beyond 80 miles if 160-mile range is selected.

After TO 1F-15-618, the destination symbol is displayed in ADI mode under the same stated conditions.

Rmax/Rmin Symbols

In MRM, the Rmax 1, Rmax 2 and Rmin symbols are displayed when radar track exists. In the SRM mode, a single Rmax and the Rmin symbols are displayed. The symbols are repeated on the HUD, and their function is the same as stated in the HUD symbol description. (Refer to TO 1F-15C-34-1-1-1 for additional information).

Break X Symbol

The break X appears in VI, MRM, or SRM modes when the pilot has penetrated the indicated Rmin range. The symbol flashes in all modes unless an MRM time-to-go countdown is in progress. In this case, the break X symbol remains steady until Tgo reaches zero. The ASE circle and steering dot are removed from the display when the break X appears in missile modes, but remain on the display in the VI mode.

VSD SUMMARY

Figure 1-30 provides a listing of the tactical VSD symbols and the avionics master modes in which they can be displayed. Air-to-ground VSD displays are described in TO 1F-15C-34-1-2.

VSD SYMBOLOGY SUMMARY

SYMBOL \ MODE	A/A MODE			VI	A/G MODE					ADI MODE				ALL MODES			
	MRM	SRM	GUN	VIS, IDENT.	AUTO	CDIP	DIRECT/MANUAL	GUIDED WPN (EO)		NAV	TACAN	ILS–NAV	ILS–TCN	CC NO–GO			
WINDOW 1:																	
TRK MEM	X	X	X	X						X	X	X	X				
JAM CODES	X	X	X	X						X	X	X	X				
RADAR SPECIAL MODES	X	X	X	X						X	X	X	X				
RADAR STBY	X	X	X	X						X	X	X	X				
MISSILE TUNE	X	X	X	X	X	X	X	X		X	X	X	X				
EO UNCAGED								X									
ALTITUDE COVERAGE	X	X		X						X	X	X	X				
TARGET TRACK DATA	X	X	X	X						X	X	X	X				
WINDOW 2:																	
RANGE RATE	X	X	X	X						X	X	X	X				
WINDOW 3:																	
GROUND SPEED	X	X	X	X	X	X	X			X	X	X	X				
TRUE AIRSPEED	X	X	X	X	X	X	X			X	X	X	X				
MISSILE TIME–TO–GO	X									X	X	X	X				
A/G TIME–TO–GO					X	X											
HOLD ALT	X									X	X	X	X				
IN RNG		X								X	X	X	X				
NO ZONE	X	X								X	X	X	X				
WINDOW 4:																	
TARGET ALT	X	X	X	X						X	X	X	X				
BIT WINDOW																	
EL BAR/PRF	X	X	X	X						X	X	X	X	X			
FLO LO	X	X	X	X	X	X	X	X		X	X	X	X				
RAM SYMBOLS (PSP)	X	X	X	X						X	X	X	X				
2 DEST INDICATOR	X	X	X	X						X	X	X	X				
TARGET/IFF SYMBOLS	X	X	X	X						X	X	X	X	X			
ACQUISITION SYMBOL	X	X	X	X						X	X	X	X	X			
RADAR A/A MODE VIDEO	X	X	X	X						X	X	X	X	X			
RADAR A/G MODE VIDEO	X	X	X	X	X	X	X			X	X	X	X	X			
EO VIDEO								X									
R_{MIN}, $R_{MAX\ 1}$	X	X								X	X	X	X				
$R_{MAX\ 2}$	X									X	X	X	X				
BREAKAWAY CUE	X	X		X						X	X	X	X				
RANGE TO TARGET	X	X	X	X						X	X	X	X				
ASE CIRCLE	X	X	X	X						X	X	X	X				
STEERING DOT	X	X	X	X						X	X	X	X				
CURSOR	X	X	X	X	X	X	X			X	X	X	X				
ARTIFICIAL HORIZON	X	X	X	X	X	X	X			X	X	X	X				
RANGE/VELOCITY SCALE	X	X	X	X	X	X	X			X	X	X	X	X			
EL SCALE	X	X	X	X	X	X	X			X	X	X	X	X			
AZ SCALE	X	X	X	X						X	X	X	X	X			
1 PSP LD	X	X	X		X	X	X	X									

1 AFTER TO 1F-15-606
2 AFTER TO 1F-15-618

15C-34-1-1-(1291B

Figure 1-30

STORES JETTISON SYSTEM

JETTISON AND RELEASE SAFETY SWITCHES

LANDING GEAR CONTROL HANDLE

When the landing gear handle is down, the ACP jettison controls are deenergized.

ARMAMENT SAFETY SWITCH

The OVERRIDE position of the armament safety switch (figure 1–31) bypasses the landing gear handle interlock. Aircraft power must be applied to maintain the OVERRIDE position. The switch remains in OVERRIDE unless manually placed OFF, or until aircraft power is removed, or when the landing gear handle is placed in the UP position. The control has no function in the emergency jettison control circuit.

JETTISON CONTROLS

EMERGENCY JETTISON BUTTON

The emergency jettison button (figure 1–31) is hot any time the aircraft is on internal or external power. When pressed, MRM missiles and the pylons and their contents on stations 2, 5 and 8 are jettisoned. Extreme caution must be observed to prevent an inadvertent ground level jettison.

SELECT JETTISON KNOB

The SELECT JETT knob (figure 1–31) is used to selectively jettison any external store.

Pressing the JETT button (in the center of the knob) provides the following functions.

COMBAT	Jettisons all external stores (including the centerline pylon) on stations 2, 5, and 8. MRM/SRM weapons do not jettison.

The following positions apply to either the L/MSL or R/MSL side of the knob.

FWD	Jettisons an MRM from a forward fuselage station (without motor ignition).
AFT	Jettisons an MRM from an aft fuselage station.
OUT	(Before TO 11L1–2–14–502) Launch–jettisons the SRM mounted on the outboard side of station 2 or 8 pylon.
IN	(Before TO 11L1–2–14–502) Launch–jettisons the SRM mounted on the inboard side of station 2 or 8 pylon.

The following positions are functional only if the A/G SELECT knob is in one of the STA JETT positions. (See A/G SELECT knob.)

STORES	Jettisons any store except the SRM from station 2, 5, or 8 pylons.
PYLON	Jettisons the pylon (and all contents) from station 2, 5, or 8.
RACK	Same as STORES.

A/G SELECT KNOB

The STA JETT positions of this control apply operate power to the STORES, PYLON, or RACK positions of the SELECT JETT knob.

R (Right)	Enables STORE, PYLON, or RACK jettison of station 8.
L (Left)	Enables STORE, PYLON, or RACK jettison of station 2.
C (Center)	Enables STORE, PYLON, or RACK jettison of station 5.
ALL	Enables STORE, PYLON, or RACK jettison of stations 2, 5, and 8.

JETTISON CONTROLS

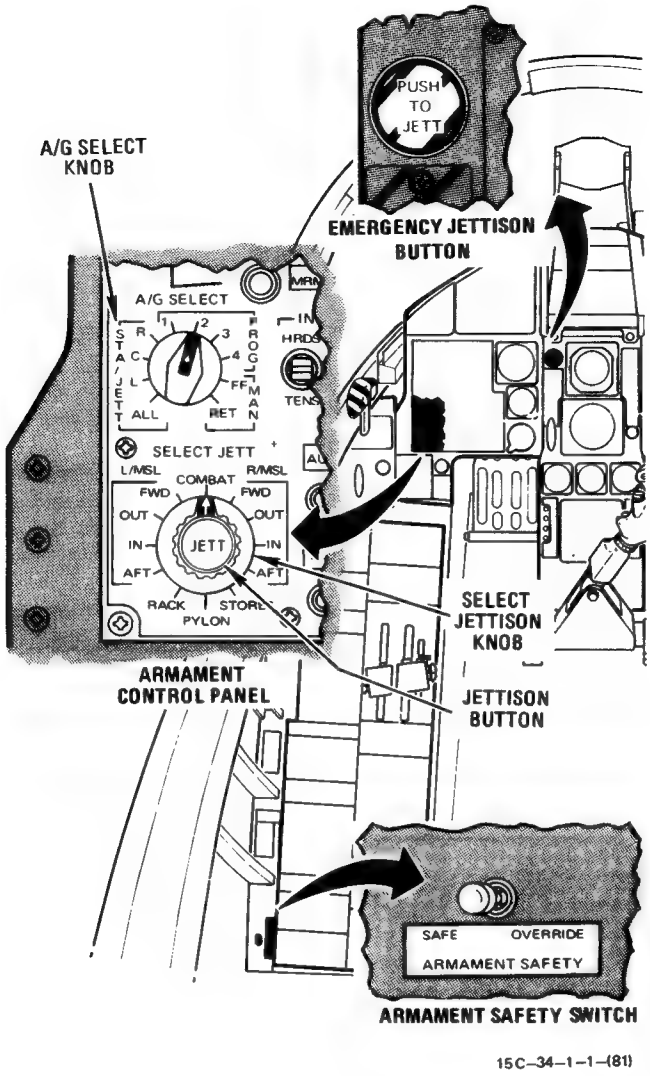


Figure 1-31

PART 2 WEAPON EMPLOYMENT

TABLE OF CONTENTS

AIR-TO-AIR WEAPON DELIVERY

RADAR EMPLOYMENT

In air-to-air situations, the pilot has three important radar operational phases to accomplish: the target detection phase; acquisition phase; and tracking phase. Any subsequent weapon selection and launch procedure is dependent on what develops during the latter (tracking) phase.

For the detection phase, the pilot would normally employ one of three pulse doppler search modes: the LRS mode, employing both HI and MED PRF; the VS mode employing only HI PRF; and the SRS MED PRF mode.

In HI PRF doppler operation, target aspect is critical to detection performance. For head-on targets, target speed adds to the fighter speed and the resultant doppler is higher than any terrain induced clutter. This is the HI PRF clear region, and accounts for the good detection performance against long range head-on targets. The HI PRF search modes are not normally useable against tail aspect targets; refer to TO 1F-15C-34-1-1-1.

The MED PRF mode, although limited in range in comparison to the HI PRF mode, does detect tail aspect targets. Low altitude, tail-aspect targets can be detected at ranges in excess of 20 miles depending on the various target and clutter parameters. Refer to SRS mode in following paragraphs.

TARGET DETECTION

Long Range Search, LRS

The LRS mode interleaves HI and MED PRF providing a near all-aspect detection capability. This mode is the primary search mode for most tactical situations, particularly where GCI is unavailable. All radar ranges and antenna AZ/EL scan parameters are selectable or may be automatically commanded. In manually selecting search parameters, the following considerations apply.

RANGE SELECTION

The pilot should select the minimum range practicable based on knowledge of the actual target range. This provides best display range resolution and a better opportunity to interpret and react to the displayed information, especially after track is established. If the pilot selects LRS and 10 NM range, the radar searches only in MED PRF, which is the SRS mode. The 160 NM range provides only HI PRF operation.

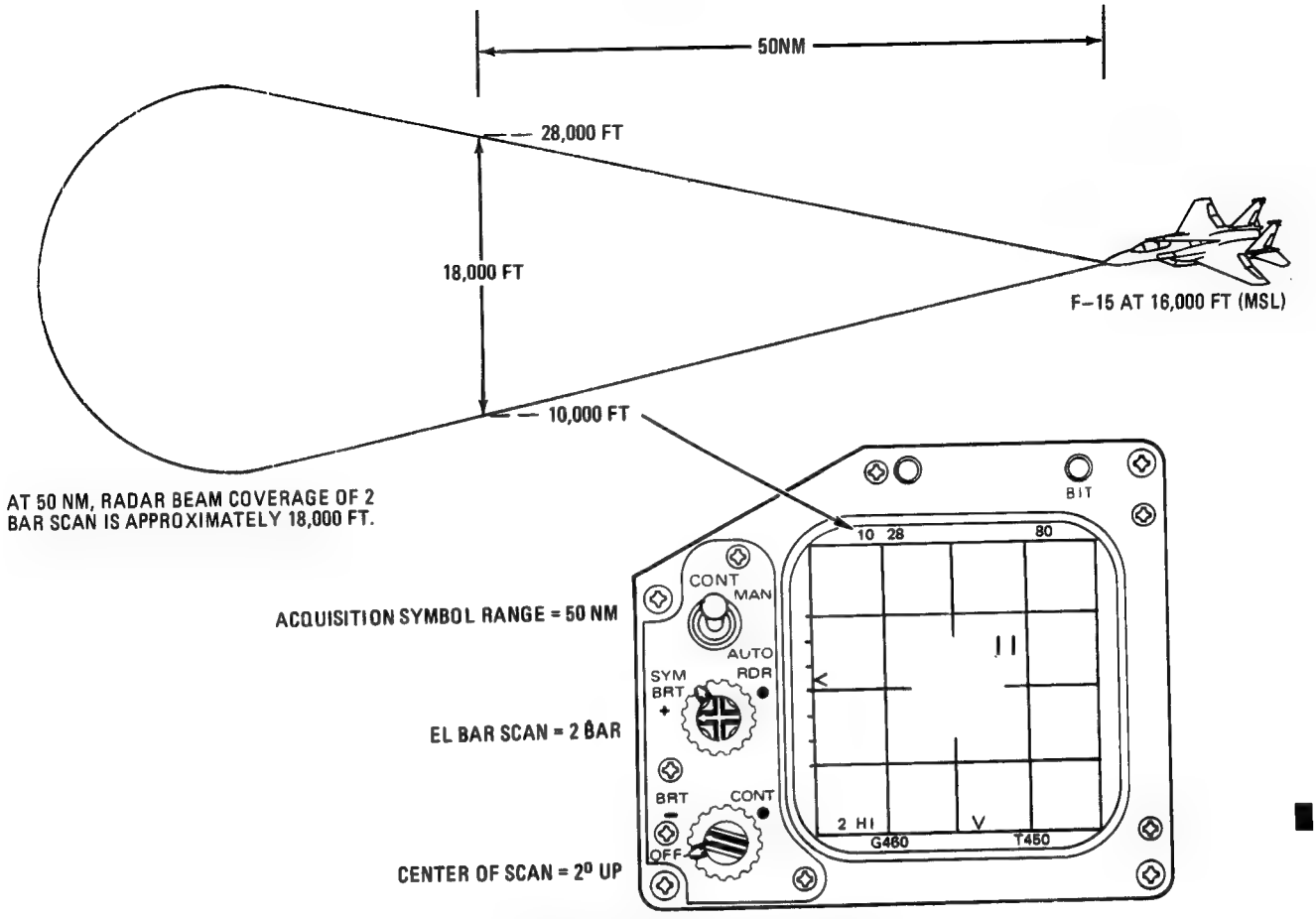
The pilot has the auto range scale switching capability if the radar AUTO mode is selected. In MRM or SRM search, the pilot can bump the range scale to the next higher or lower scale by positioning the acquisition symbol to the extremities of the VSD display. In track with any weapon selected, a range scale automatic change is based on the range of the target.

ELEVATION SELECTION

With a reported target, establish search in the target altitude area by utilizing the VSD altitude coverage data. The data relates the maximum and minimum beam elevation coverage (MSL) in the present selected bar/EL scan, and at the displayed acquisition symbol range. The table in figure 1-32 shows the beam spatial coverage at various ranges. Adjust the antenna elevation control (if necessary) until the VSD altitude coverage encloses the reported target altitude. Adjust the bar scan to a lower setting. This increases the detection capability in the scan area. During patrol missions, use assigned altitude coverage areas among flight members. For example, the lead aircraft might scan an altitude area of 25,000 to 50,000 feet; the wing element scans from 0 to 25,000 feet.

AZIMUTH SCAN SELECTION

ALTITUDE COVERAGE



RADAR BEAM ELEVATION COVERAGE

EL BAR SCAN	ANGULAR COVERAGE	SPATIAL COVERAGE (FEET X 1000) AT RANGE:							
		10 NM	20 NM	30 NM	40 NM	50 NM	60 NM	70 NM	80 NM
1	2.5°	2.7	5.3	8.0	10.6	13.3	15.9	18.6	21.2
2	3.5°	3.7	7.4	11.1	14.8	18.6	22.3	26.0	29.7
4	5.5°	5.8	11.7	17.5	23.3	29.2	35.0	40.8	46.6
6	7.5°	7.9	15.9	23.8	31.7	39.7	47.7	55.6	63.6
8	9.5°	10.1	20.1	30.2	40.3	50.3	60.4	70.4	80.5
AUTO SRM: 4 BAR WIDE (2.5° SCAN)	10.0°	10.6	21.2	SAME AS 4 BAR SCAN ABOVE FOR RANGE SELECTIONS GREATER THAN 20 NM					

15C-34-1-1-(144)C

Figure 1-32

The azimuth scan selection should be the minimum possible based on prior knowledge of target position. This reduces the antenna frame time and improves detection capability. With no reported target, the 120° scan is normally used.

FRAME STORE SELECTION

.e selection of target data aging is normally a function of the current flight conditions. In head–down situations, a lower setting will avoid confusion between aged targets and any new targets. In head–up situations where the pilot cannot often check the VSD, a higher setting may be desirable. Figure 1–33 illustrates the detection of two targets utilizing multiple frame storage. For the longer range target, the wider spacing between detections indicates a higher relative target closing velocity compared to that of the lower range target. (Before PSP) If the aircraft is turning, the aged targets will be displayed in azimuth across the VSD. The use of data aging may assist the manual lockon task when the F–15 is maneuvering. The trend displayed across the VSD by the aged targets may be used to apply a small amount of lead in positioning the acquisition symbol on the current target return. This may position the acquisition scan for the required time to achieve lockon.

In PSP aircraft, the heading–stabilized display (HSD) and 3–frame storage (with selectable GMTI) modifications are added. With HSD, stored targets on the VSD are shifted in azimuth to compensate for F–15 heading changes. This ovides a positive indication of a target's relative position ng an F–15 maneuver. The acquisition symbol is simi- stabilized during manual acquisition. The pilot no onger has to lead a stored target when attempting lockon in a turn.

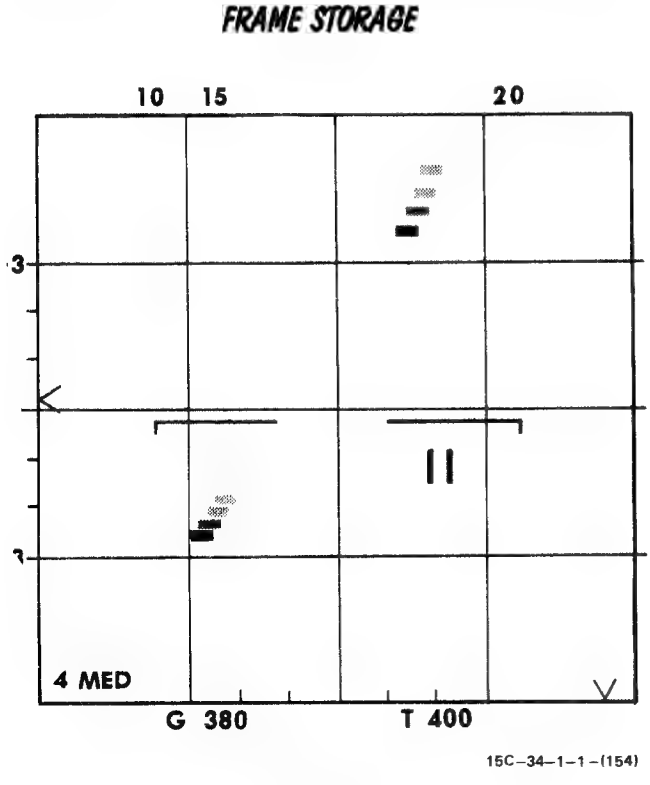


Figure 1–33

CHANNEL SELECTION

The channel select capability may be used to avoid mutual interference between aircraft in formation or in the same area. Mutual interference (false alarms) is caused by the receipt of radar signals from another aircraft on the same or adjacent channel. It usually appears as a large group of random targets (birds) on the VSD, appearing as the interfering radar antenna sweeps across the aircraft. Mutual interference can appear from ground reflected radiation, which may occur during a head–on pass. The interference can appear in LRS, VS, and SRS radar modes, and either in OPR or STBY operations. This form of interference can be avoided or minimized by changing channels. Aircraft in the same flight should operate on different channels. Refer to Mutual Interference, TO 1F–15C–34–1–1–1.

Velocity Search, VS

The VS mode is used to provide early detection of reported targets in the long range, high closure rate, head–on aspect environment. The mode employs only high PRF, and only nose aspect targets with a relative ground velocity greater than 80 knots can be detected, displayed and acquired. The pilot can select the 160 NM range and increase the VS detection/velocity scale by 300 knots for situations where high velocity targets are reported. The acquisition symbol/velocity position on the VSD is read in window 2. Occasionally, modulations from moving parts on the target such as engine turbine blades, can create higher order doppler returns from nose or tail aspect targets which result in detections exhibiting false velocity information. These are commonly referred to as JEM (Jet Engine Modulation) line detections.

All antenna azimuth and elevation scan patterns are selectable using the same considerations stated in the preceeding paragraphs. It is important to note that for altitude coverage information, the acquisition symbol position (in range) on the VSD is based on the range selected on the radar knob. For example, if the pilot has 40 miles selected on the range knob and the acquisition symbol is located in the center of the VSD, then the altitude coverage data is based on a 20–mile range. The radar range knob selection also determines the VSD range scale displayed after lockon. Since the search display is velocity vs. azimuth, the detected target's vertical position remains constant on the VSD unless target maneuvering changes the closing velocity component.

Short Range Search, SRS

The SRS mode may be used in the short range, lookdown, clutter environment to detect both opening or closing rate targets. SRS is obtained automatically if GUN or SRM is selected in the radar AUTO mode. The pilot may manually select 10, 20, and 40 NM ranges in SRS. In the 10 to 40 mile range, the MED PRF has the better capability to break-out targets in a multi–target environment, compared to the HI/MED interleaved PRF. In track, the MED PRF provides better range resolution (than HI PRF) at ranges where MED PRF track can be maintained.

TARGET ACQUISITION PHASE

Manual Acquisition

Manual acquisition is accomplished using the same procedures for all modes. During the search phase, all targets detected and displayed are stored in terms of target range, azimuth, and elevation bar on which detection occured. The radar utilizes the stored data during the following procedure.

a. Use the TDC to bracket the target with the acquisition symbol.
b. Press the TDC; the radar is commanded to a $\pm 3°$ scan pattern (mini-raster) centered on the acquisition symbol, and at the selected bar scan.
c. Release the TDC to command lockon. The system now looks for a correlation between the designated target and the target data stored in memory. Upon correlation, the antenna goes to a rapid 2 bar, $\pm 3°$ scan on the correct bar/PRF where the target was detected. Upon receipt of a second live hit, track is established.

If lockon is not successful, the scan remains in mini-raster, and in the bar scan the pilot has selected. In an attempt to achieve lockon:

a. Rotate the elevation knob forward and rearward to vary altitude coverage. Also, vary the position of the acquisition symbol in range. Lockon occurs if a target is detected within the acquisition symbol coverage, even though the target may not have been initially displayed in the mini-raster.
b. If lockon does not occur, press the auto acquisition switch and return to search.

The track display presented is a function of the weapon selected on the throttle. The upper part of figure 1-34, sheet 1, shows VSD detection and acquisition displays in the LRS mode. In the resulting track display the pilot has acquired the left most target. The track display shows all available target tracking parameters, including the MRM Rmax and Rmin indicators. In the lower part of the figure the same targets are shown but the pilot has selected VS. The search display shows the left target's relative closing speed is approximately 500 knots, the middle target's relative speed approximately 100 knots, and the right target's closing speed approximately 1000 knots. After initial target acquisition in VS, target range may not be immediately resolved since range resolution requires slightly more signal strength. The display goes to B-scan (range vs. azimuth), but no range dependent tracking parameters are displayed and the target is not displayed (display 2). The range rate readout, normally adjacent to the range caret, is placed at the center of the display. As soon as target range is resolved, a full track display appears.

Figure 1-34, sheet 2, shows the MRM track displays continuing through the launch sequence. If acquisition occurs in high PRF, the radar automatically track transfers to medium PRF (display 3) when range closes to approximately 30 miles. (The actual range where transfer occurs is a function of target size and signal strength.) Transfer to medium PRF occurs automatically; selecting MRM and master ARM will not prevent the transfer.

Displays 3 and 4 would actually show a range scale change from 80 NM to 40 NM if the pilot had the radar AUTO mode selected. Auto range scale switching occurs when the tracked target moves inside the lower 45% of the display. The Tgo symbol (display 4) is the AIM-7 predicted time of flight and the value updates as range changes. At MRM launch, the Tgo symbol flashes and begins countdown to missile impact (display 5). When range closes to 1.2 Rmax 1, the radar is automatically commanded to transfer back to HI PRF track if the pilot has selected MRM and master ARM. However, if the target is near beam aspect in a look-down position relative to the F-15, or is tail aspect, transfer may not occur. In these situations it may not be possible to transfer to HI PRF track depending on relative sizes of target and ground clutter. In this situation, a change in the F-15 heading should be attempted to obtain HI PRF track. With all steering and tracking parameters satisfied, the pilot may proceed to MRM launch. (Refer to AIM-7 MRM attack, in subsequent paragraphs.)

The SRS 10-mile search display and the SRM and gun track displays are shown in figure 1-35. The SRM track display is basically the same as the MRM except that a single Rmax symbol is generated, and missile Tgo is not generated since there are no steering requirements after launch. The gun track display is a back up steering display used when a visual on the target is lost. The circle represents the HUD field of view. If the HUD symbology is lost, the pilot flies to position the dot in the center of the circle to aid in establishing a visual on the target.

Auto Acquisition Modes

The auto acquisition modes are enabled by switching methods described in Part I. The selection of an auto acquisition mode depends on the ACM situation the pilot observes. Any previous target lockon must be rejected before an auto acquisition mode can be selected. Once lockon occurs from any mode, the pilot may select any air-to-air weapon/track display.

BORESIGHT AUTO ACQUISITION

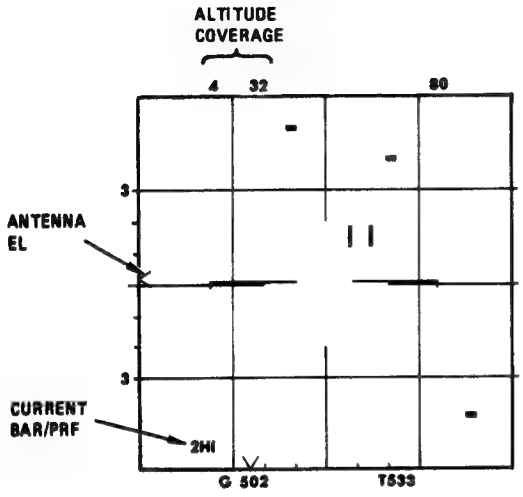
The boresight (BST) mode is expected to be the most rapid and reliable acquisition method in the visual, short range, high maneuvering target situation. The target must be maintained along the radar boresight line and the pilot must steer to keep the target within the 4° BST circle on the HUD. Before PSP with PULSE selected, the BST mode is LO PRF (with limited look-down capability). After PSP, the BST mode is always in MED PRF regardless of the radar mode selected.

SUPERSEARCH AUTO ACQUISITION

When supersearch is selected, the radar automatically scans the HUD FOV $\pm 10°$ in azimuth and 20° in elevation. The pilot is required to maintain the target within the HUD 20° circle, which is displayed when the mode is selected. Lockon in supersearch is most reliable when the target remains fairly stationary in the HUD FOV. The target must remain in the beam a sufficient time for radar detection and lockon to occur. Any combination of fighter and target maneuvering which results in excessively high angular rates, or no relative doppler frequency (90° beam

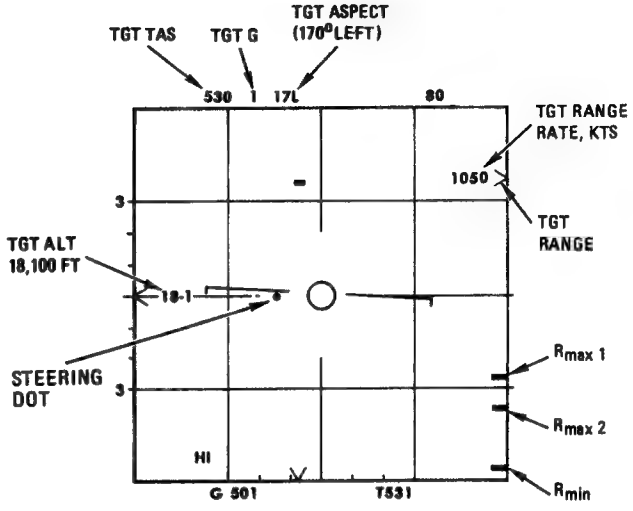
VSD DISPLAY, MRM

SEARCH

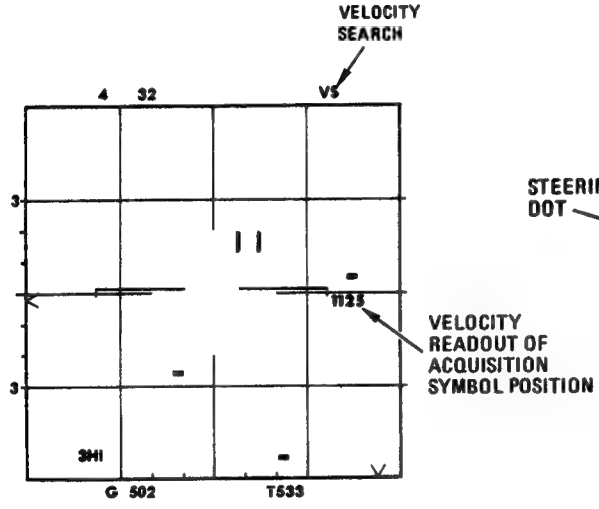


1. DETECTION, RADAR IN LRS.

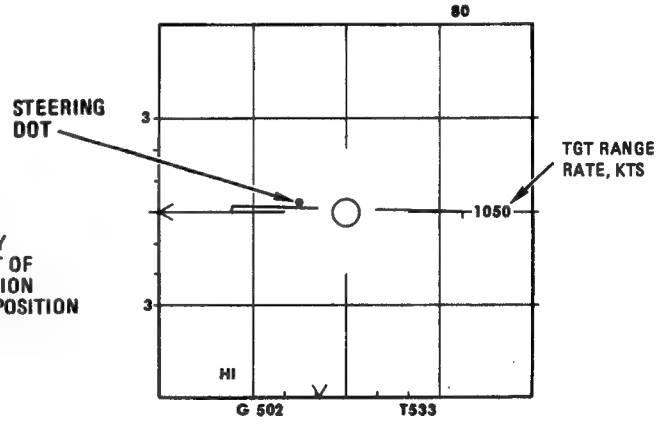
TRACK



2. TRACK ESTABLISHED FROM LRS OR VS, MRM SELECTED.



1. DETECTION, RADAR IN VS.



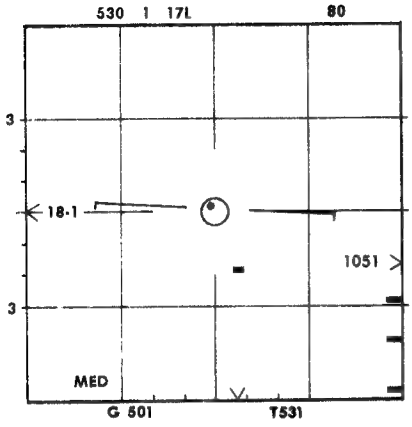
2. INITIAL TRACK FROM VS (ANGLE & VELOCITY TRACK ONLY).

15C-34-1-1-(143-1)

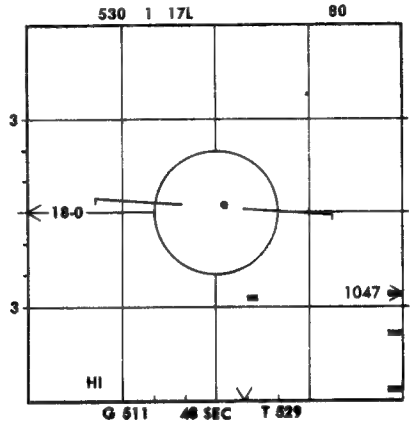
Figure 1-34 (Sheet 1 of 2)

VSD DISPLAYS, MRM (Continued)

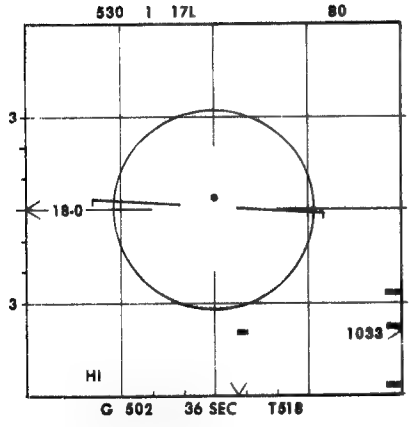
TRACKING TO LAUNCH AND BREAKAWAY



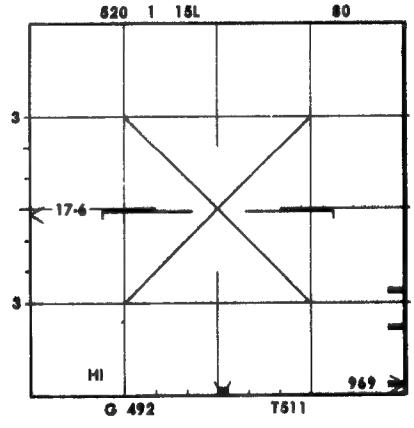
3. MRM SELECTED, TRACK TRANSFER TO MEDIUM PRF.



4. MRM, TRACK TRANSFER BACK TO HIGH PRF, IN RANGE, Tgo STEADY



5. MRM LAUNCH, Tgo FLASHING

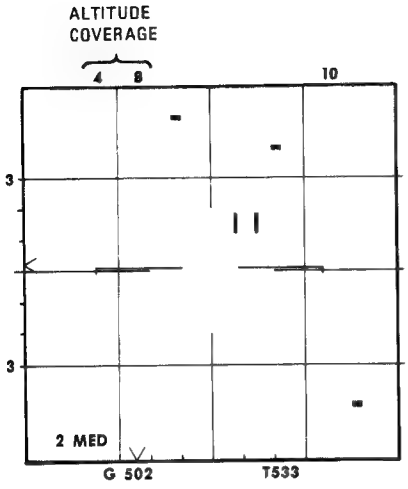


6. BREAKAWAY.

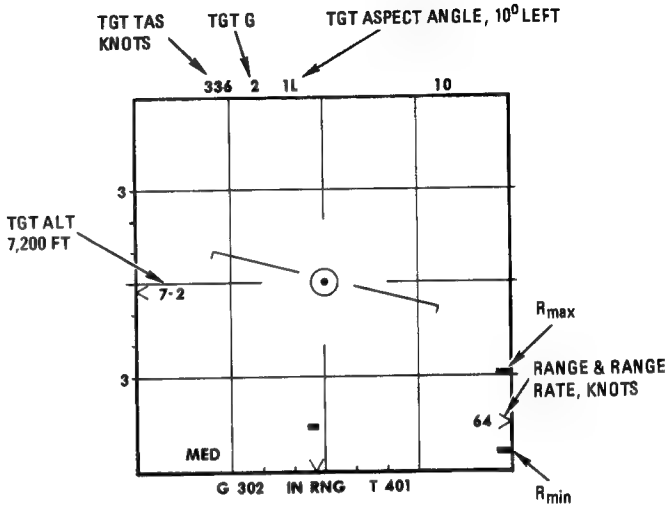
15C-34-1-1-(143-2)

Figure 1-34 (Sheet 2)

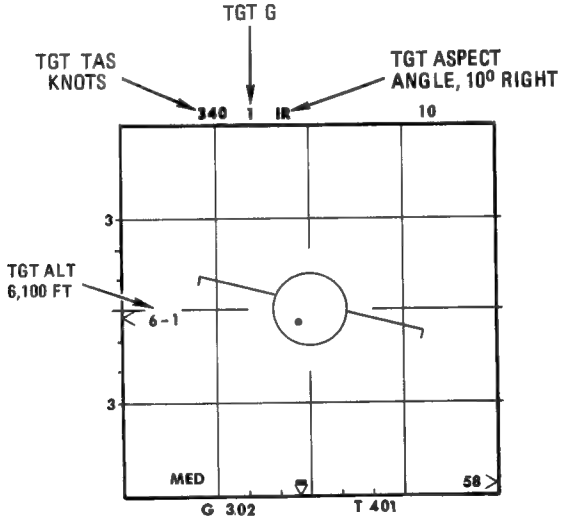
VSD DISPLAY, SRS



1. SHORT RANGE SEARCH (SRS).



2. SRM TRACK DISPLAY.



3. GUN TRACK DISPLAY.

15C-34-1-1-(142)

Figure 1–35

aspect angle) may preclude or delay supersearch lockon. With multiple targets in view, it may be difficult to determine which target will be acquired first. When acquisition occurs, the HUD TD symbol will indicate the target being tracked.

VERTICAL SCAN

The vertical scan mode provides the auto acquisition capability against visual, look-up aspect targets. The scan pattern center is indicated by the vertical symbol on the HUD. To obtain lockon, the pilot must fly to maintain the target within the scan, rolling the aircraft when necessary to keep the target vertically aligned in the scan. The lock/shoot lights are particularly useful in this mode to indicate the missile launch-ready (shoot cue) condition while maintaining visual contact with the target.

AUTO GUN SCAN

This mode provides an auto acquisition scan that is not restricted to the forward FOV area. It is the only auto acquisition mode that is space stabilized. VSD altitude coverage data is based on a 5 NM range. The mode uses a long pulse MED PRF, which provides higher detection sensitivity at the outer extermity of the auto acquisition range (10 NM), but limits lockon to no less than 0.5 NM. The throttle TDC is used to position the scan to the AZ/EL limit of the radar. The pilot can turn into and slew the scan in the direction of a target reported in the beam or rear area and attempt rapid lockon, and select the SRM or MRM for launch.

Selecting REJECT will reinitialize the scan center to 0° AZ/EL, or initiate bump acquisition if track had been established. During the gun scan search, the pilot may select any other auto acquisition (short pulse) mode which allows lockon at ranges as close as 500 feet.

Reacquisition, Track Memory

The track memory and reacquisition logic is activated when the radar (during track) experiences a signal loss. Beyond 10 NM range and after a signal loss of 3 seconds duration, MEM is displayed on the HUD and VSD for 3 seconds while the radar extrapolates the last known target position and velocity. Then the radar enters the reacquisition sequence (6 bar ±3° raster, HI/MED PRF) for up to 6 seconds. If a signal return is received at any time during this sequence of events, the radar re-enters the normal track mode. If not, the radar returns to search.

For ranges less than 10 NM and because the track geometry becomes more dynamic as range decreases, the probability of the target being at the extrapolated position after several seconds is reduced. For target ranges between 5 and 10 NM, the radar immediately enters the reacquisition sequence (in MED PRF) after a 3 second signal loss period (MEM is not displayed). If the target is not reacquired during a 4.5 second reacquisition sequence, the radar returns to search. For the highly dynamic situation where target range is less than 5 NM, a 3 second reacquisition sequence follows a 1.5 second signal loss period.

Sometimes a tail reacquisition results in a HI PRF lockon of jet engine modulation (JEM). This JEM line lockon occurs when the return energy from the target has been modulated by the rotating blades of the jet engine to produce lines in the doppler frequency spectrum at a higher frequency than the doppler return from the target. When the radar locks on one of these lines in HI PRF, the apparent closing velocity (and the closing velocity readout) is much higher than the actual closing velocity betweer the target and fighter. For this reason, the radar uses MED PRF reacquisition if the previous track range was less than 10 NM. The radar has a JEM resolving capability in MED PRF track.

Raid Assessment Mode (PSP Aircraft)

The expanded scan properties of RAM provide greater resolution and sensitivity than normal MED PRF search. Targets relatively close together in range and less than beam width apart can be resolved in RAM either as distinct targets or as a multi-target indication. The pilot can enter the RAM mode, examine the target area and either retain the original single target track (STT) or redesignate another target, and return to STT for missile launch. If an MRM is intended, the pilot must return to STT to obtain the HI PRF track compatible for MRM launch. The radar will automatically attempt to obtain HI PRF track at RAM exit if the designated target is inside missile Rmax. If the HI PRF acquisition attempt fails, then MED PRF is attempted. When MED PRF track is obtained the pilot must wait for a successful MED to HI PRF track transfer occurrence.

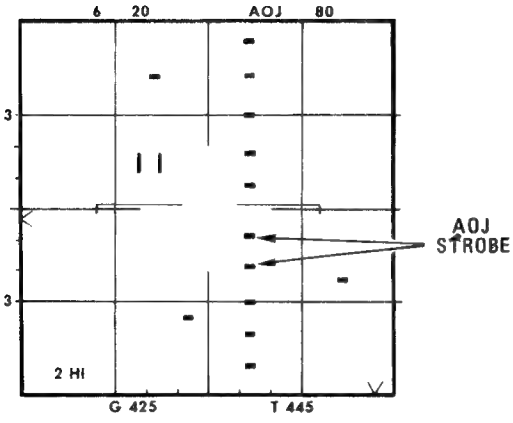
Any RAM to STT transition attempt (whether or not pilot commanded) will initially be made (for approximately 1 second) with the antenna spotlighted at the last known designated target position. If unsuccessful a 2 bar, ±3° mini-raster acquisition as attempted. If STT is achieved from the spotlight attempt, then most likely the designated target has been acquired. If STT is achieved from the mini-raster acquisition, then any of the targets within the ±3° field-of-view may be acquired. After return to HI PRF STT, the radar track may again be susceptible to the effects of multiple targets within the beamwidth. This can be noted by observing oscillating mag heading and aspect angle data, and steering dot excursions. These effects are less likely to occur in medium PRF track in which range and doppler discrimination are available to help maintain reliable STT data.

The 6° circle, Rmax, Rmin, and track data on the VSD perimeter indicate designated target positional changes and whether or not the target is within weapon range. Weapon attack steering does not appear on the VSD; however a full weapon attack steering display appears on the HUD.

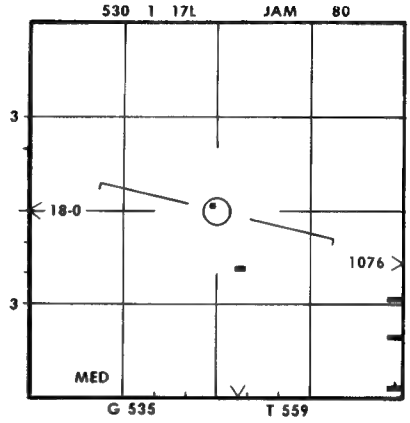
ELECTRONIC COUNTER COUNTERMEASURE (ECCM) MODES

The radar ECCM features provide the capability of detecting the presence and location of ECM devices. Special circuits automatically configure the radar for optimum search, acquisition, and track performance

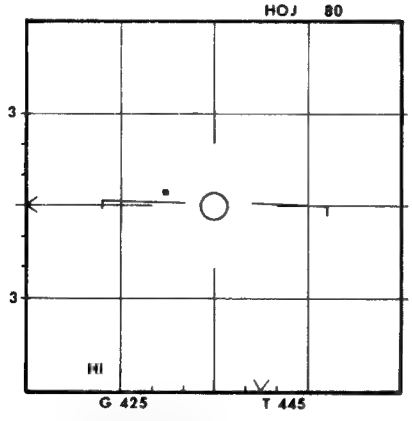
ECCM DISPLAYS



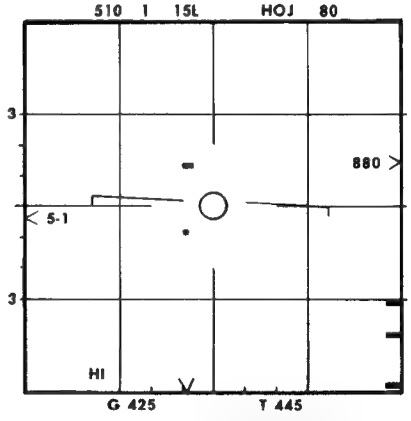
1. AOJ DISPLAY.



2. JAM TRACK DISPLAY.



3. HOJ (ENTERED FROM AOJ).



4. HOJ (ENTERED FROM TRACK)

15C-34-1-1-(170)

Figure 1-35A

against jamming devices such as repeater or noise jammers. The pilot is alerted to the presence of a jamming environment when JAM, AOJ (angle of jam), and HOJ (home on jam) cues are displayed on the HUD and VSD. The AOJ cue is displayed during search operation. The JAM and HOJ cues are displayed during track operation.

In AOJ operation, a series of synthetic targets are displayed at the azimuth coordinate of the jammer. When a specific threat is detected during radar track, the radar automatically changes mode of operation to the configuration best suited to counter the detected threat. The ECCM displays are shown in figure 1-35A. In PSP aircraft, the presence of a jamming device does not inhibit the RAM mode.

Angle of Jam (AOJ)

The AOJ cue identifies the ECM threat as a noise jammer and is displayed only during search operations. The relative bearing of the jammer is indicated by the AOJ strobe, which consists of a row of 9 or 10 target symbols. The symbols are evenly spaced in range at the azimuth position of the jammer. In the LRS medium PRF scan with the 160 mile range selected, only six target symbols are displayed because the radar will only process out to 100 NM in medium PRF search. The AOJ cue appears as soon as jamming is detected. The AOJ strobe appears when the antenna scans past the jam source position. With the frame store set at zero, the AOJ strobe remains displayed until the end of the current bar scan. If the frame store is set at one or more frames, the strobe is displayed until the end of the next bar scan. Angle tracking of the jamming source can be accomplished by using the normal lockon procedures on any of the synthetic targets. After TO 1F-15-595, auto gun scan lockon to the AOJ strobe is inhibited. The other auto acquisition modes or normal search may be used to acquire the ADJ strobe. At lockon, the radar system switches to HOJ operation. In the auto acquisition modes, the noise source is automatically acquired if the jammer is within the antenna scan coverage.

False AOJ displays may be presented when other radar (ground or airborne) systems are operating in the area. After TO 1F-15-595, mutual interference induced AOJ strobes are not displayed on the VSD, but the AOJ cue is displayed on the HUD and VSD. Clutter feedback can also cause false AOJ indications, however, this usually occurs only during takeoff or landing.

Home on Jam (HOJ)

During normal target tracking operations, the HOJ cue is displayed when the target begins operating a noise jammer. The HOJ cue is also displayed when HOJ is entered from an AOJ condition as previously mentioned (figure 1-35A). During HOJ operation, only angle tracking is possible since range and velocity track are denied by the noise jammer. When HOJ is entered from normal skin track, the radar extrapolates target range and range rate information based on memorized target parameters. The track display is the same as before the HOJ period, except that the HOJ cue is displayed. When HOJ results from acquisition of an AOJ target, range and range rate are not available for the display. In this case, the track display consists only of the azimuth and elevation carets, PRF cue, and the ASE circle and steering dot. The HOJ cue is displayed for as long as the noise jamming persists or until target burnthrough occurs and full tracking is automatically achieved. The radar will automatically evaluate full tracking capabilities at approximately 3-second intervals during HOJ operations.

RF CHANNEL SELECTION

The CHAN thumbwheel on the radar set control provides a manual selection of any of the six radar frequencies spread over the RF band. When A is selected, the radar automatically channel hops at the end of bar scan whenever noise jamming is sensed (AOJ strobe). When a clear channel is found, the radar remains in that channel until noise jamming is once again sensed. If no clear channel is found, the radar will continue to randomly select any of the 6 channels at each end of bar. During HOJ periods, if A is selected, the radar searches for a clear RF channel at nominal 9-second intervals.

JAM Track Operation

In track, the JAM cue can be displayed during high, medium, and (before PSP) low PRF operation. The JAM cue is displayed after detection of deception ECM devices other than noise jammers, for example: velocity gate stealers. The display remains as long as the condition is active. While JAM is displayed, the radar is automatically seeking a problem solution in varous modes; the pilot should be aware that any target parameters indicated (range, velocity, altitude, G, aspect angle, etc.) may be highly inaccurate. If the radar solves the ECM problem, the JAM cue is removed and all tracking parameters are valid subsequent to a small settling time. Refer to TO 1F-15C-34-1-1-1 for additional information.

ECCM PRF Selection

Refer to Radar Employment, TO 1F-15C-34-1-1-1.

SNIFF Mode

The SNIFF mode is a special purpose active/passive mode which provides silent surveillance (passive) and active search capabilities with minimum radiation time to prevent detection. With SNIFF selected on the SPL mode knob, the radar ceases transmissions at the end of the current bar scan and operates in a receive-only (STBY) mode with a single bar scan. Any noise jamming is detected as the antenna scans across the jammer. Temporary active transmissions can be initiated by holding the auto acquisition switch in REJECT. This commands the radar to transmit in the selected mode for the duration of a single azimuth scan unless the selected mode is LRS, in which case the transmitter is activated for two azimuth scans; one in high PRF and one in medium PRF. At the end of the active scan period, the radar returns to a passive state. During the active scan, targets received are retained on the display until REJECT is released. The normal lockon procedures can be used to acquire any target detected during the active scan. When the TDC is actuated for acquisition, the SNIFF mode is terminated and active transmissions are initiated.

AIM-7 MRM ATTACK

The MRM missile attack may be visual with or without radar lockon, or on instruments with radar lockon. Target illumination and the launch envelope are primary factors in an MRM missile attack. The most accurate and primary mode is presented on the HUD and VSD when radar lockon is available. If radar HI PRF lockon is not available (or degraded), the FLOOD mode is automatically activated at missile launch.

STEERING AND DISPLAYS, AIM-7F

The HUD and VSD display presentations are determined by the radar set mode of operation. The MRM steering modes are radar track, flood, and (before PSP) manual track.

Radar Track

When MRM is selected while tracking a target in the MED PRF, the radar continually attempts to transfer target track to the HI PRF waveform. The lead angle error (LAE) command steering dot and ASE circle are displayed. If radar range is not available, a fixed range is used in the computation of the LAE steering dot and the ASE circle diameter is fixed to a preset value. The CC provides commands to generate and position the steering dot on the HUD and VSD and the target designator on the HUD. When target range is available, the maximum AIM-7 aerodynamic launch range (Rmax 1), the maximum maneuvering target launch range (Rmax 2), and the minimum launch range (Rmin) of the missile are computed. If the target range is within the computed Rmax 1 and Rmin limits (and the missile seeker limit), the IN RNG cue is displayed on the HUD and the Tgo cue appears on the VSD. The MRM shoot cue is displayed and the lock/shoot lights flash when all MRM launch parameters are satisfied. When target range is less than Rmin (MRM not inflight), a flashing breakaway cue is displayed on the HUD and VSD to indicate that the attack should be terminated. If a missile is inflight when target range becomes less than Rmin, a steady breakaway cue is displayed. When missile Tgo has expired, the breakaway cue will flash. The ASE circle and steering dot are removed from the HUD and VSD when the breakaway cue (steady or flashing) appears.

Flood Mode

The MRM FLOOD mode is automatically activated by the radar set during the MRM launch sequence whenever the radar is not tracking in HI PRF, or when the radar is in a track extrapolate condition and the target is within the flood antenna coverage. During the extrapolate period, the range scales and caret are removed but the Rmax and Rmin strobes remain on the HUD and VSD. After TO 1F-15-618, the Rmax and Rmin strobes are displayed only if the range scales and target range are displayed. The 12° MRM reference circle is displayed on the HUD and the FLOOD cue is displayed. All available radar RF illumination is radiated from the flood antenna for target illumination. Optimum conditions exist in FLOOD if the pilot has achieved full radar track (any mode and PRF) when the MRM launch signal is applied. This enables all MRM prelaunch commands. Steering involves positioning the visual target within the FLOOD reference circle. Refer to AIM-7 MRM Attack, in TO 1F-15C-34-1-1-1.

Manual Track Mode

(Before PSP) in MAN TRK the pilot manually tracks the target by using the TDC to position the acquisition symbol over the target return on the VSD. Since the pilot is manually positioning the radar range gate and antenna with the TDC, target range and angle data is available for MRM command steering. The command steering dot and a fixed ASE circle are commanded on the VSD and HUD. The range marker is displayed on the VSD range scale. If the pilot launches in this mode, the FLOOD mode is activated.

In PSP aircraft the MAN TRK mode is not available. See TO 1F-15C-34-1-1-1.

AIM-7 LAUNCH

When the weapon release button is pressed, the ACS activates the missile battery and relays all prelaunch commands. After 1.4 seconds, the launcher ejector cartridges are fired. With the extension of the forward ejector foot, the motor fire signal is sent to the missile. When the missile ident signal is lost, the ACS selects the next missile in the launch sequence; updates the launched missile status display from RDY to dash; and indicates RDY in the status display of the next missile. However, if

the weapons select switch is moved out of MRM prior to loss of the missile ident signal, the launch will be aborted and that missile status will change to HUNG.

The launch sequence is: right forward, right rear, left forward and left rear. If the pilot elects to fire two missiles in succession, the weapon release button is pressed and released, then pressed and held until the first missile is observed to launch.

The HUD camera is turned OFF 10 seconds after the weapon release button is released.

AIM-9J/J-1/P/P-1 SRM ATTACK

When the pilot selects SRM position on the throttle, the ACS establishes the predetermined launch sequence of the SRM, and displays STBY in the missile status indicator for the missile station which is first in the launch sequence.

STEERING AND DISPLAYS, AIM-9J/J-1/P/P-1 SRM

With the SRM mode established, the CC monitors the radar tracking status to establish the best available steering mode. If the radar is not angle tracking, the pilot may ignore radar acquisition procedures and steer to position the target in the 2° (missile boresight) circle, obtain the SRM tone, estimate the launch envelope, and then proceed with launch procedures. If the pilot attempts radar acquisition, selecting SS auto acquisition provides a 20° reference circle; selecting BST provides a 4° reference circle. If the pilot uses head-down (TDC/VSD) radar lockon procedures, the 2° circle remains on the display.

With lockon established the command steering dot is displayed on the VSD, and the TD symbol appears on the HUD. The launch Rmax and Rmin symbols are also displayed on the HUD and VSD. When the range to the target is within the Rmax and Rmin launch range limits and when the radar antenna line-of-sight rate is within the maneuverability limit of the SRM missile, IN RNG is displayed on the HUD and VSD and the SRM shoot cue is displayed on the HUD. The circular range bar and Rmin tab is displayed when radar range becomes less than 12,000 feet. When the target range is less than the computed Rmin, a flashing break X symbol is displayed and the CC discontinues the display of the SRM steering commands.

If the target is not visible, the pilot must fly to position the VSD steering dot within the ASE circle. If the target is visible, the pilot maneuvers to position the target within the HUD 2° circle. When the SRM seeker detects the target, the missile tone is generated in the headset.

NOTE

SRM volume is adjusted through the WPN knob on the ICC panel, left console.

If the pilot does not receive the detection tone, pursuit steering must be continued until the tone is available. The pilot may reject the selected missile and step to the next missile in the launch sequence by pressing the missile reject button on the throttle.

When steering and range conditions are satisfied and with the IR tone present, the pilot may launch one or more missiles. Because the AIM-9J/J-1 may not capture the target when launched with the target near the edge of the reference circle (or tone area), the target should be centered as much as possible before launch. With the AIM-9P/P-1 missile, the seeker should lock on any time the tone is present, and centering the target is not critical.

In some cases, the pilot may choose to uncage the priority missile seeker by pressing and releasing the nose gear steering button. When this is done, missile tone might drop in volume or modulate, or go OFF completely (even though the missile locks on). If more than one missile is ripple fired, the tone may not be present between missile launches. What the tone does depends on present conditions of range, aspect, maneuvering, and target throttle setting. Missile uncaging may be desirable to simplify the steering task; the pilot need only keep the target within the HUD field of view. The tone must be present prior to uncaging.

AIM-9J/J-1/P/P-1 SRM LAUNCH SEQUENCE

The pilot applies the launch signal by pressing the weapon release button. The ACS provides the launch command to the priority missile and to the CC for HUD camera activation. When the RDY missile is launched (300 to 900-msec delay), the missile ident signal is lost at that station. The ACS selects the next missile in the launch sequence and updates the display from RDY to a dash. If a malfunction inhibits launch, the status display is updated to HUNG, the hung missile is removed from the launch sequence, and the next missile in the launch sequence is selected. The CC updates the missile count on the HUD and de-energizes the HUD camera 10 seconds after pressing the weapon release button. The missile select and launch sequence is L OUTBD, R OUTBD, L INBD, and R INBD.

As far as launch circuitry is concerned, SRMs may be launched in rapid succession. The only requirement is that the ACS RDY indication is available for each succeeding missile in priority. However, the pilot must obtain the detection tone before any launch. When firing at a boresighted target, the detection tone for the next RDY missile should be available with little additional steering. When firing off boresight (seeker uncaged) or at a second target, the pilot must maneuver to center the target in the SRM FOV circle and acquire the detection tone before committing another missile.

AIM-9L SRM ATTACK

When the pilot selects SRM with the weapon select switch, the ACS displays STBY in the missile status indicator for the missile station which is first in the launch sequence.

Cooling of the AIM-9L seekers should be initiated at least 25 seconds before missile launch. Cooling may be manually selected with the option pushbutton; it is automatically selected in the SRM mode when the master arm switch is placed to ARM.

AIM-9L missile control and the various displays depend on whether the radar is tracking or not tracking the target. The primary distinction between these two conditions is in the slaving of the priority missile seeker head. If the radar is not tracking, the priority missile seeker head is positioned to boresight. The priority seeker may be nutating or held stationary. Nutation increases the effective FOV and aids in target detection. The nutation (SCAN) option is automatically selected for the priority missile when SRM is selected; however, the pilot has the option of rescinding nutation. Press the SCAN rescind button on the armament control panel to rescind nutation; press the SCAN option button to restore nutation. All remaining missile seekers are caged. If the radar is tracking the target, the priority missile seeker head automatically slaves to the radar antenna LOS.

STEERING AND DISPLAYS, AIM-9L SRM

When the SRM mode is selected, the CC monitors the radar track status to establish the best available steering mode.

No Radar Track

All AIM-9L missile seeker heads are aligned to the missile boresight position while the radar is in search. The seeker head position circle on the HUD is centered in the FOV circle, and the FOV circle size is dependent on the scan or non-scan option. The boresight centerline is depressed approximately 44 mils below the gun cross (9 mils below FRL). The pilot must maneuver to center the target in the FOV circle. When the SRM seeker detects the target, the missile detection tone is presented in the headset.

NOTE

The SRM tone volume is adjusted by the WPN knob on the ICC panel (left console).

With the target in the FOV circle and the detection tone ON, the pilot may launch immediately or select uncage to attempt seeker self track (lockon). Press the seeker uncage button on the control stick (one time); UNC (uncaged) is displayed on the HUD. When in SCAN, an audio threshold in the ACS must be exceeded before lockon can occur. Lockon is indicated by removal of the FOV circle and the detection tone changes to a chirping tone. The pilot may now steer off boresight and use the entire HUD FOV in maneuvering to a launch position. The seeker position circle remains on (or near) target LOS while maneuvering. The pilot may launch the missile when within the estimated launch envelope.

With Radar Track

With radar track established, the FOV circle on the HUD is replaced by a steering dot and an ASE circle and target range is displayed in HUD window 4. The ASE circle remains constant in size regardless of SCAN selection/rescind. The pilot must steer to center the dot.

The AIM-9L missile seeker in priority is slaved to the radar antenna LOS; all other seekers remain aligned to the missile boresight position. Therefore, the HUD TD symbol and the seeker head position symbol are coincident. This is the visual cue that the AIM-9L seeker has successfully slaved to radar antenna LOS and that the two lines of sight are within angular coincidence limits. There may be transient periods in which the two lines of sight are not coincident, particularly during maneuvers.

When range closes within Rmax and Rmin limits, the IN RNG cue is displayed on the HUD and VSD. When range reaches 12,000 feet or less, the range bar with Rmin tab is displayed inside the ASE circle.

When the detection tone is ON and the shoot cue displayed, the pilot may launch the SRM or attempt seeker self track by pressing UNCAGE. For the AIM—9L, the shoot cue indicates IN RNG, ACS audio threshold, and radar antenna/missile seeker coincidence. Therefore, whether the pilot chooses to UNCAGE or not, the shoot cue is a reliable indication that guidance after launch will be successful.

The pilot may observe a flashing shoot cue. This is caused by the missile alternately exceeding then dropping below ACS audio threshold. There is no way to site the exact conditions in which the cue will flash. With the seeker uncaged, the flashing shoot cue will most likely occur in level flight with a point source target and with a blue sky background. (No other IR sources in the vicinity). This is a more positive indication of reliability (than the steady cue) and should cause no launch indecision.

AIM-9L lockon is indicated by the ASE circle which doubles in size and by a chirp audio tone. The TD and SRM seeker symbols are displayed independently. Seeker circle offsets of up to 1° or 2° from the center of the TD box may be present due to inherent missile and aircraft tolerances. Circle jitter of up to 0.2° may also be present. Although the ASE circle doubles in size, the circle still represents the steering envelope.

If a malfunction is observed and the pilot wishes to select another missile, the missile reject button is pressed. The next missile in sequence becomes the priority missile. If the radar is tracking and either the target or F-15 maneuvering results in masking of the selected SRM station, the priority automatically changes to another missile unless UNCAGE has occurred. After UNCAGE, masking causes the missiles to break lock, but the priority will not change. When the next missile becomes priority, the seeker slaves to radar LOS and the tone/acquisition procedure must be repeated.

If target range becomes less than Rmin, the following cues alert the pilot to break off the attack.

a. A flashing break X cue is displayed on the HUD and VSD.
b. The ASE circle and command steering dot displays are removed from the HUD and VSD.

AIM-9L SRM LAUNCH SEQUENCE

The pilot applies the launch signal by pressing the weapon release button. The ACS provides the launch command to the selected missile and to the CC for HUD camera activation. When the RDY missile is launched (300 to 900-msec delay), the missile ident signal is lost at that station. The ACS selects the next priority missile in the launch sequence and updates the display from RDY to a dash. If a malfunction inhibits launch, the status display is updated to HUNG, the hung missile is removed from the launch sequence, and the next priority missile in the launch sequence is selected. The CC updates the missile count on the HUD and de-energizes

the HUD camera 10 seconds after pressing the weapon release button. With the radar angle tracking, the next priority missile will be one that is not masked. If there are only hung missiles or no missiles present on the unmasked side of the aircraft, the priority missile will remain on the masked side. The missile seeker head of the new priority missile is positioned to boresight (radar not tracking), or positioned to the radar LOS (radar tracking). The next missile may be launched when the TONE and/or self track requirements are satisfied.

AIR–TO–AIR GUNNERY

In the A/A gunnery mode, the CC solves for a predicted point of impact by developing a solution to the vector diagram shown in figure 1–36. The solution is computed in terms of aircraft azimuth and elevation coordinates, not earth coordinates. The net AZ–EL solution relative to the gun line is a function of trajectory shift, gravity drop, and kinematic lead vectors briefly defined below. The resultant is the lead angle, which is the angle formed between the gun bore line and the pipper sight line with the pipper on target.

Trajectory Shift	Bullet line of departure, which is an intermediate path between the gun muzzle velocity vector and the aircraft flight path vector.
Kinematic Lead	The continuous change in position between the target and the F–15; a function of pitch, yaw, roll, and acceleration of the F–15 combined with bullet time–of–flight.
Gravity Drop	The 1–G acceleration of gravity combined with bullet time–of –flight.

To accurately display lead angle, fuselage flexure and gun harmonization are also computed. The vectors are briefly defined below.

FLEXURE COMPENSATION

The HUD rotates in pitch with respect to the gun under high load factor flight conditions due to flexure of the forward fuselage. The flexure correction is computed in the CC based on gun and HUD boresight angles, aircraft normal acceleration, true airspeed, and air density ratio.

GUN HARMONIZATION COMPENSATION

The gun and HUD gun cross are harmonized at a range of 2250 feet forward of the gun muzzle. At other ranges, this results in a parallax error (see section IV). The CC computes continuous gun harmonization using:

a. Actual radar range if available and not overridden by reticle stiffen.
b. 1000 feet if reticle stiffen is selected.
c. 2250 feet if radar range is not available and reticle stiffen is not selected.

GUN DISPLAY UTILIZATION

During an aerial encounter, the position of the pipper on the combining glass is of little importance while the aircraft is well outside the gun tracking range and the pilot is maneuvering for position. For any one set of maneuvering conditions, the greater the range, the greater the instability of the sight reticle. The reticle display may be made less sensitive to aircraft motion by depressing the reticle stiffen button on the outboard throttle. The stiffened reticle presentation is computed based on a fixed range of 1000 feet and a fixed closing rate of 50 feet/second, rather than the range and range rates provided by the radar. The reticle range bar continues to display the radar range.

Depending on the firing position the pilot achieves, the reticle may be utilized as either a tracking reticle or as a damped tracer point. As a tracking reticle, the pilot must achieve a position so that the reticle can be superimposed and maintained on target when the gun is fired. As range decreases, the most important single factor which the pilot must properly control is aircraft load factor. The load factor applied while pulling the pipper into the target should be constant. Then the act of stabilizing the pipper on target (at firing range) is a matter of holding a G that has already been obtained, and for which the CC has already compensated. The computations provide the correct lead angles and the aircraft flies a lead pursuit course. The appearance of the lag line on the HUD indicates that the sight is not in solution. The lag line is removed, or reduces in length, only when the load factor

LEAD COMPUTE GEOMETRY

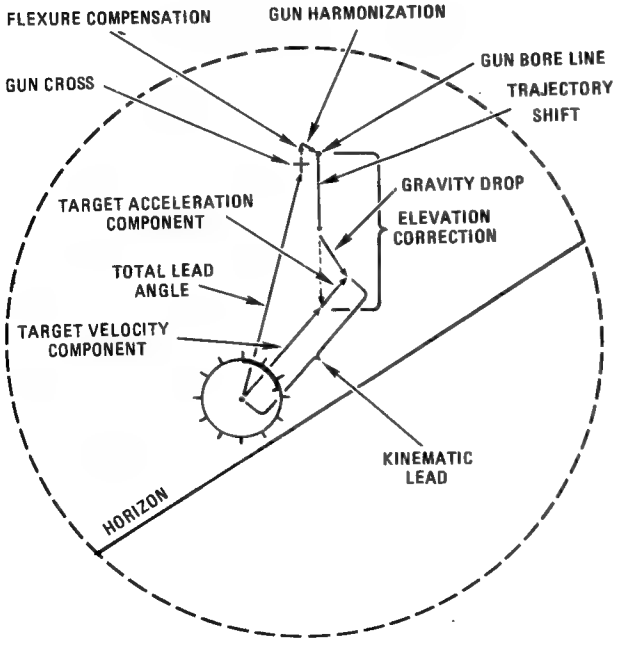


Figure 1–36

is constant. In lead pursuit, the best technique is to fly the pipper into the target (at constant G if possible), stabilize until the lag line reduces to only a few mils in length, then fire.

If the encounter is not suitable for reticle tracking, the pipper can be considered a damped tracer point. The sight is performing in the very same manner as it does in the lead pursuit encounter; the projectile must pass through the pipper which is being superimposed on the aerial target. Therefore, a projectile fired at any given time will hit the target one time–of–flight later if the attack aircraft has maintained a relatively constant maneuver both before and after the firing. This damped tracer characteristic can be used to obtain snap–shoot hits during non–tracking encounters. The aircraft must be flown so that the target and pipper are moving toward a common interception point. Momentarily maintaining a constant load factor (lag line minimized), the pilot fires when the pipper is judged to be displaced one time–of–flight plus gun delay time from interception. Thus, the pilot must provide the anticipation required so that the projectiles will be in the pipper when it intercepts the target.

Either of the previous techniques can be utilized with the reticle stiffened. However, the computations will be correct only when the target is at the stiffened range of 1000 feet. In order to solve the fire control problem at any other range, the pilot must provide additional compensation. The reticle will continue to provide the actual radar range on the analog bar.

Either of the previous techniques can be utilized without achieving radar lockon. In this case, the pilot must judge when the target is at the fixed range of 2250 feet. This can be done by estimating range using the target wingspan and the reticle circles.

WINGSPAN VS. TARGET RANGE

The pilot may estimate the air–to–air target range using the 25 and 50–mil diameter reticle circles and the known wingspan of the target. For example, the F–15 wingspan (WS) is 42 feet; at a 1700–foot range, the aircraft would fill the 25–mil reticle circle.

(1000) (42 feet WS. ÷ 1700 feet range) = 25 mils dia. (approx.).

The plot in figure 1–37 provides values of mils diameter as a function of target wingspan and range.

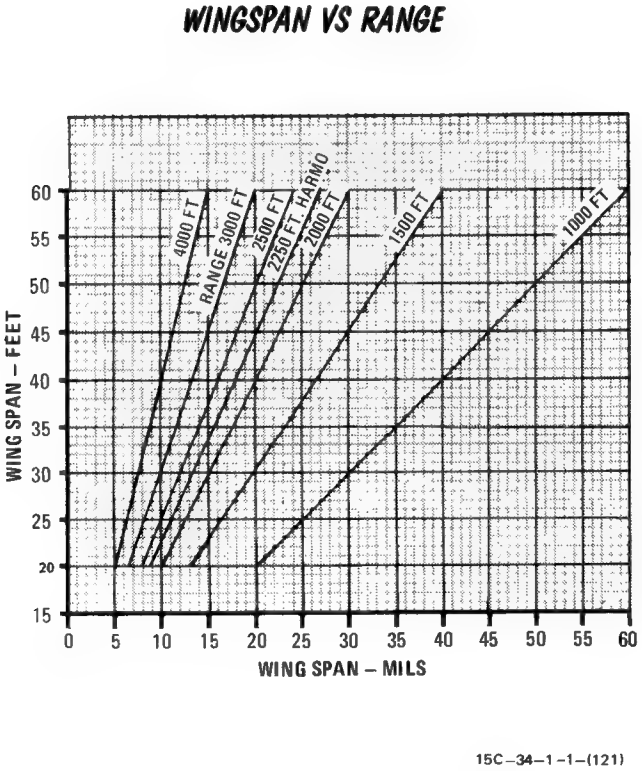


Figure 1–37

PART 3 SUSPENSION EQUIPMENT

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AIR-TO-AIR WEAPON SUSPENSION

LAU-106/A LAUNCHER, AIM-7F MISSILE

There are four fuselage mounted missile stations. The launcher (figure 1-38) has two gas operated ejector pistons which eject the missile prior to motor fire. Each launcher is electrically and mechanically protected from inadvertent firing of the ejector cartridges by a ground safety pin.

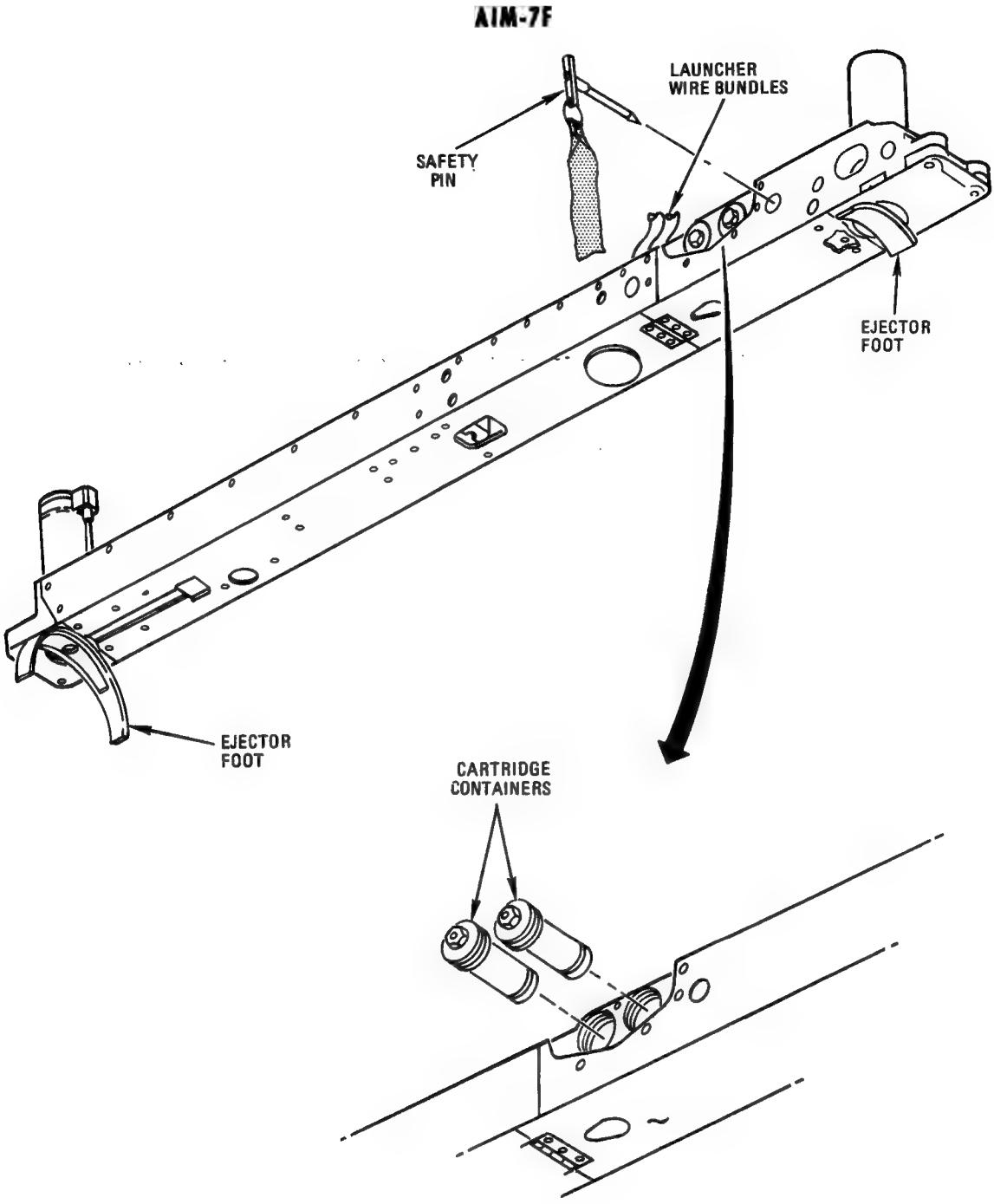
LAU-114 LAUNCHER, AIM-9 MISSILES

The missile launchers are attached to ADU-407/A launcher adapters which are bolted to each side of the inboard armament pylons (figure 1-40). The launcher contains a detent and snubber mechanism that retains the missile on the rail. After TO 11L1-2-14-503, a rear detent locking pin is installed to ensure that the SRM will not slide rearward during flight. When the rocket motor ignites, the thrust overrides the forward detent spring allowing the missile to begin forward travel along the launcher rails. Each launcher is electrically protected against inadvertant missile launch by a ground safety pin which is removed immediately prior to flight. Production launchers now receive a nose fairing release pin which prevents the fairing from opening during flight.

The AIM-9L missile cable is connected directly to the missile umbilical receptacle. If the AIM-9J/P is aboard, an adapter plug is removed from its stowed position and installed on the umbilical receptacle to receive the AIM-9J/P cable. After TO 11L1-2-14-502, the launcher jettison circuit is disabled.

The launcher is equipped with fin retainer springs for use with AIM-9L only. The fin retainer springs snap over the trailing edge of each pair of missile fins to prevent fin flutter during captive flight. The fin retainer springs automatically disengage when the missile is launched.

LAU-106/A MISSILE LAUNCHER



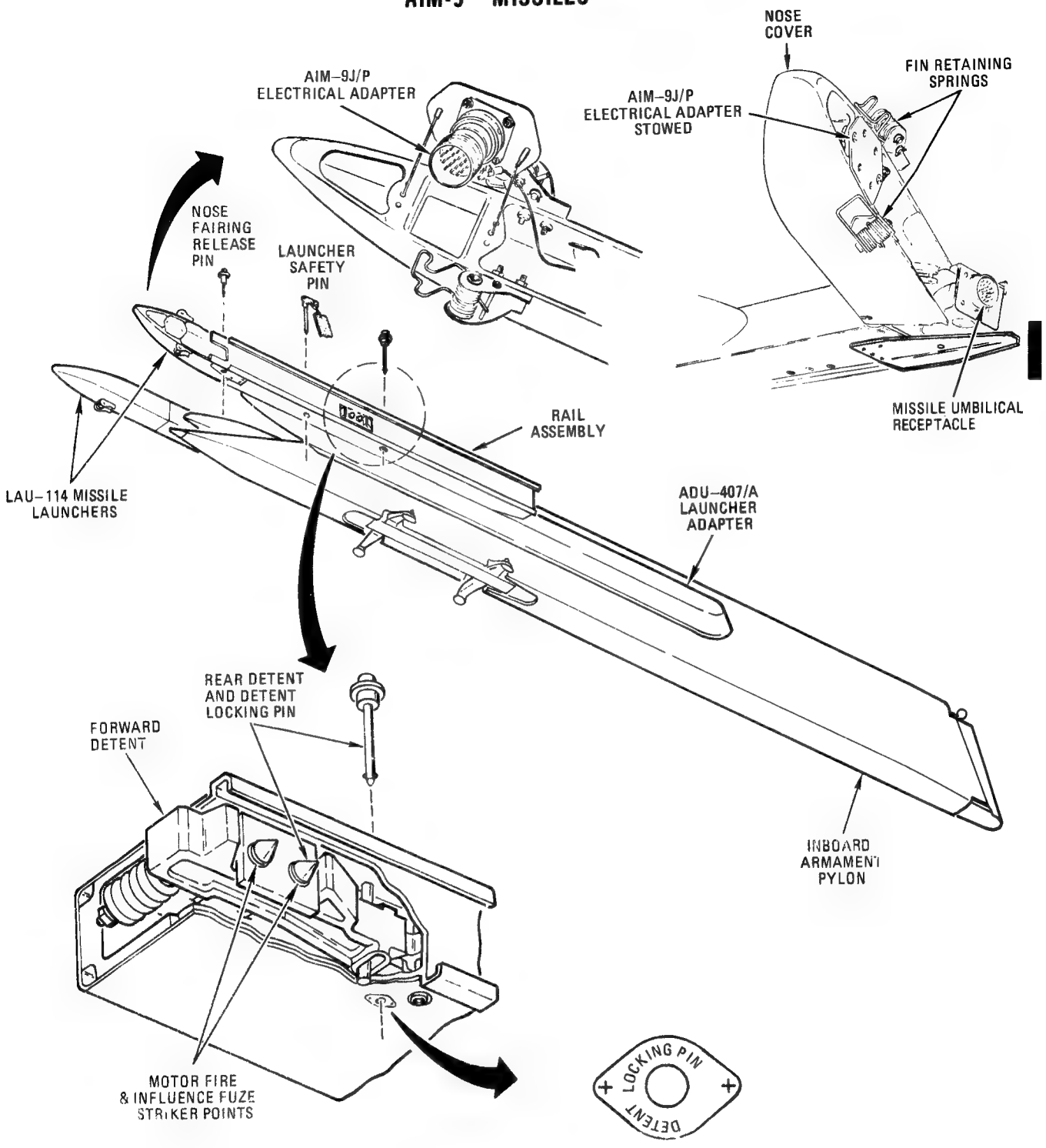
15C-34-1-1-(88)

Figure 1-38

All data on page 1-67, including figure 1-39, deleted.

LAU-114 MISSILE LAUNCHER

AIM-9 MISSILES



15C-34-1-1-(164)D

Figure 1-40

ARMAMENT PYLONS

The inboard and centerline armament pylons (figure 1-41) provide suspension for a single store or a fuel tank. Each pylon contains a permanently installed MAU-12C/A ejector rack. The pylons may be jettisoned directly off the aircraft by using the emergency jettison or the selective jettison procedures (refer to Stores Jettison System). During jettison, the pylon is restrained by the aft pivot point to provide an initial nose down pitch moment for safe separation. A pylon ejector safety pin provides an electrical lock in the ejection system.

Fuel tank carried on the pylon is attached directly to the MAU-12C/A suspension hooks. Each rack contains two cartridge breeches and ejector pistons. When the cartridges detonate, gas pressure opens the rack hooks and forces the ejector pistons down, ejecting the tank. An ejector rack safety pin provides a mechanical lock in the hook linkage.

ARMAMENT PYLONS

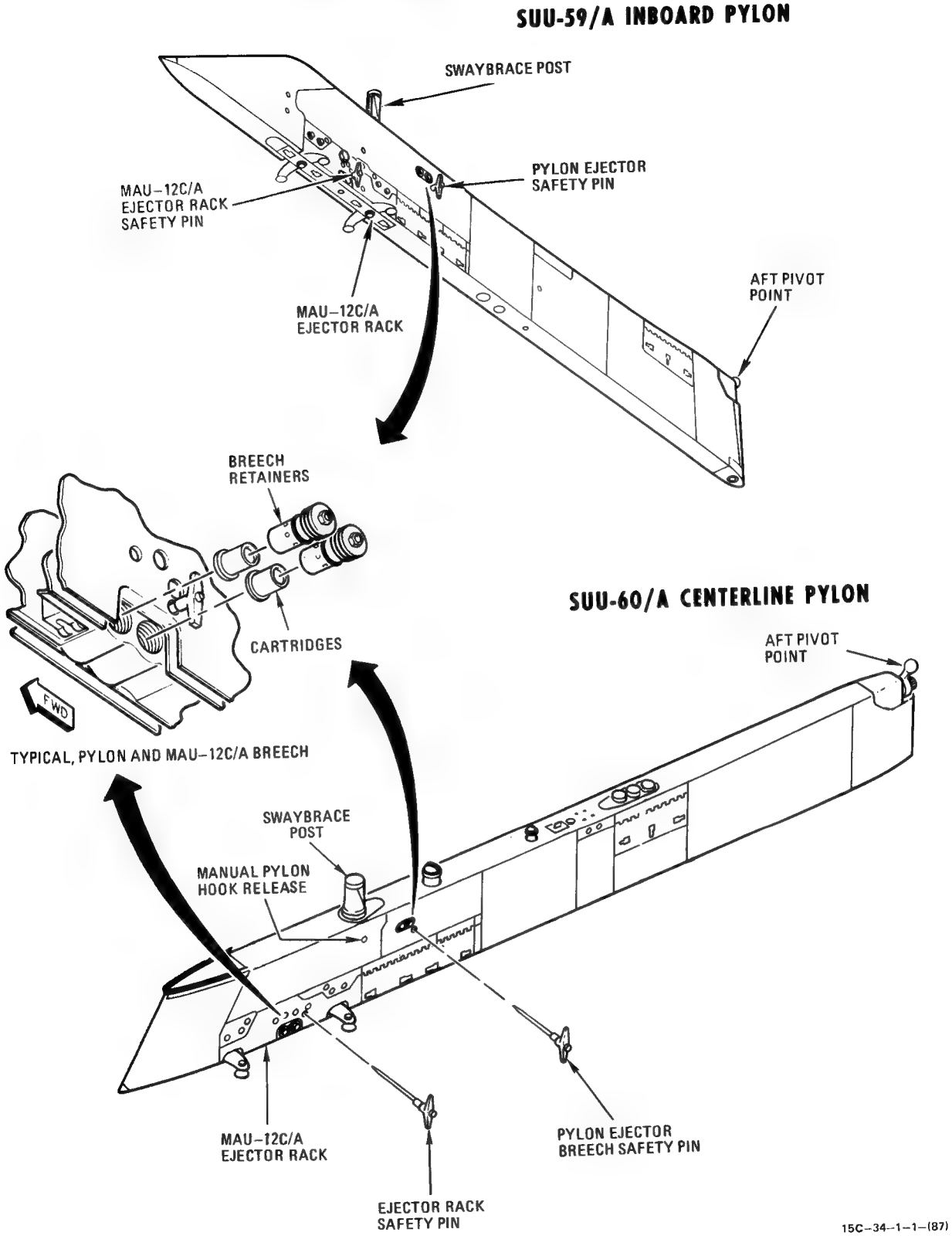


Figure 1-41

PART 4 AIRCRAFT WEAPONS

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COMBAT WEAPONS

M61A1 GUN SYSTEM

The internal gun system is an electrically controlled, hydraulically powered, air cooled, forward firing 20mm gun mounted in the right shoulder area of the center fuselage section. The gun has selectable firing rates of 4000 or 6000 shots per minute (SPM). Pilot control of the entire system is exercised through the ACP and the trigger. The major system components include the M61A1 gun, the ammunition storage drum and conveyor assemblies, and the hydraulic power and gearbox assemblies that provide the gun drive power (figure 1–42).

The M61A1 has a rotating cluster of 6 gun barrels. Each barrel fires once per revolution to fire a total of 6000 rounds per minute (100 rounds per second) when the barrel cluster is rotating at 1000 rpm. The muzzle velocity is 3380 feet per second. The total ammunition capacity is 940 rounds.

AMMUNITION DRUM AND CONVEYOR SYSTEM

The drum assembly (figure 1–42) provides storage for the 20mm ammunition, and is directly linked to the ammunition conveyor system and the return conveyor system. An exit unit removes ammunition from the drum, and an entrance unit returns spent cases, misfired rounds, and cleared rounds to the drum. The complete ammunition cycle forms a closed loop from the ammunition drum to the gun and return.

HYDRAULIC POWER SUPPLY

The gun system is driven by the aircraft utility hydraulic system. The rate of fire is controlled by the rate switch on the ACP. The trigger signal energizes the power supply hydraulic motor which drives the gun and drum feed system.

GUN ELECTRICAL CONTROL

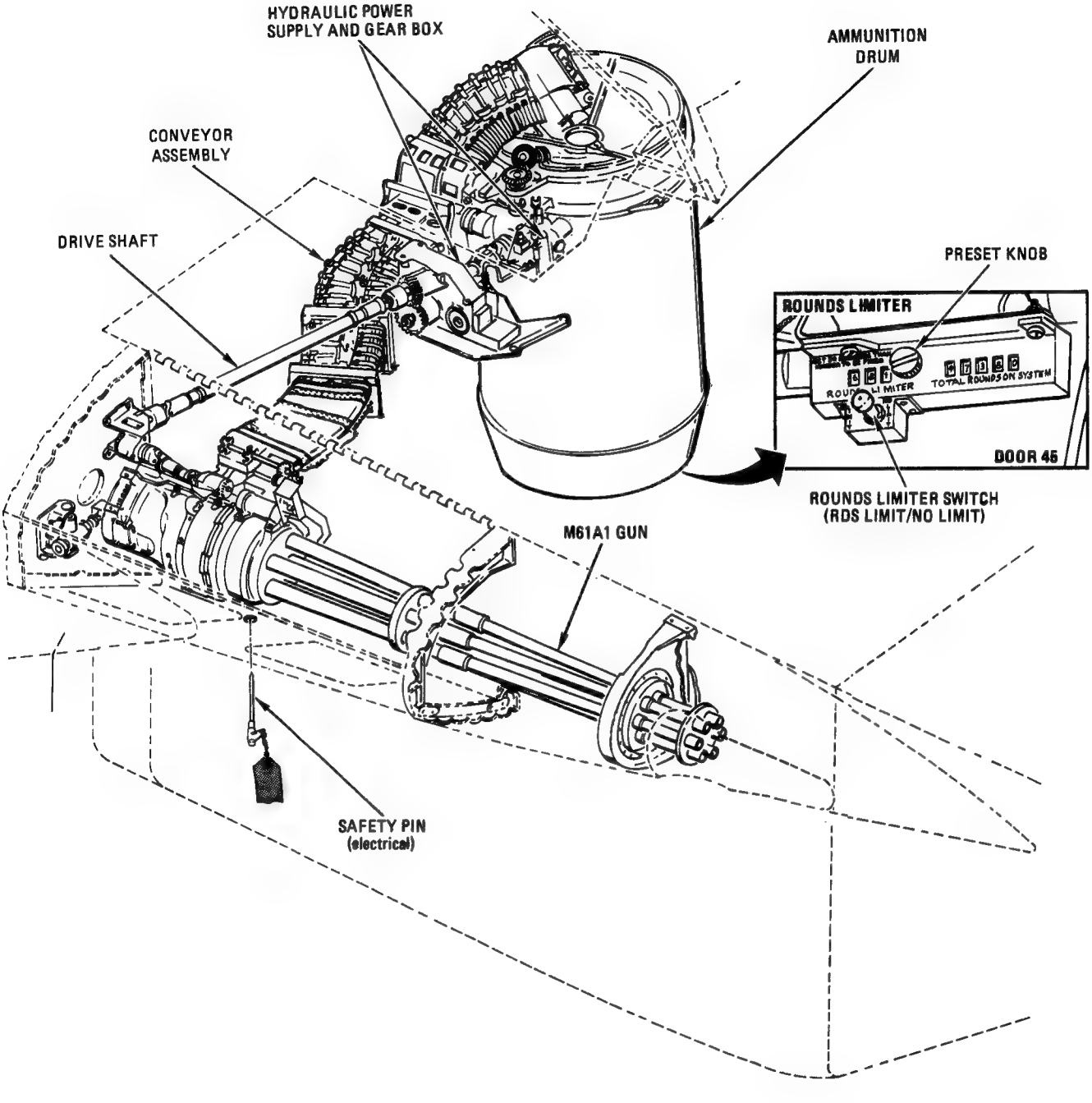
The electrical power requirements for gun operation is applied through the ACS by pressing the trigger second detent. The trigger is hot with the landing gear handle UP and master arm energized. During ground operations, a safety pin (figure 1–42) is installed into a safety switch assembly to interrupt gun fire voltage. A red streamer attached to the safety pin should be visible just below the gun fairing in the right wing shoulder area.

Rounds Limiter, Set Knob and Limit Switch

The rounds limiter device mounted on the ammunition drum system may be adjusted by armament crew personnel when it is necessary to limit the quantity of rounds to be fired during one flight. The device has a counter unit which is set to actuate a rounds limiter switch and stop gun operation after the determined number of rounds have been fired.

The rounds set knob is adjusted to limit gun firing to a desired number of rounds. This control is rotated clockwise to decrease the limit, and counterclockwise to increase the

M61A1 GUN SYSTEM



15C-34-1-1-(11)

Figure 1-42

limit. The desired number of rounds to be fired is registered on the 3-place counter located adjacent to the set knob. The rounds limit toggle switch must be in the LIMIT position for this mode of operation.

NOTE

If the rounds limiter is set above 799 with limit switch in LIMIT, the gun will not fire.

GUN OPERATION

The number of rounds loaded on board is set into the rounds remaining counter on the ACP by a manual set control. This may be set in increments of 10 up to 990 rounds, providing an instant read-out of current ammo status. The gun rate switch is positioned to a 4000 or 6000 SPM rate depending on mission requirements, and the master arm switch is positioned to ARM. The pilot presses the trigger to the second detent to fire the gun and operate the HUD camera. The gun reaches the set firing rate in approximately 0.4 seconds. The throttle weapon select switch can be in any position for gun operation, but must be in GUN for gun mode steering.

Gun Clearing

Gun clearing functions occur automatically. When the pilot releases the trigger, round fire and counting voltage is maintained on the gun until hydraulic braking action causes deceleration to a firing rate of 3900 $\pm$150 SPM. At this point, all six bolt assemblies are locked in the cleared position. The delay between trigger release and the point at which incoming rounds are no longer chambered and fired is such that approximately 5 to 11 rounds will fire after the trigger is released. This depends on the initial firing rate. The time period between the last round fired and complete gun stop results in 4 to 9 live rounds clearing the gun and returning to the drum. The total time period between trigger release and gun full stop is slightly less than 1 second. During this period, the trigger is disabled and the pilot must delay at least this long between bursts.

CAUTION

The usable ammunition can be completely fired out with a single burst or fired in short bursts. To reduce possible gun damage and prolong gun life, short bursts are recommended.

The clearing functions occur when the pilot releases the trigger, when the preset LIMIT of rounds have been fired, or when empty rounds appear in the last rounds switch assembly located in the drum hand-off unit.

Ammunition, 20mm

The components that make up a complete round or cartridge used in the M61A1 gun are: a brass or steel cartridge case, an electric primer, propellant powder, and the projectile. The complete cartridge is approximately 6-5/8 inches long and weighs approximately 1/2 pound. The projectile is fired when an electrical pulse is applied to the primer.

20mm Target Practice

The 20mm target practice cartridge (TP) (figure 1-43) is ball ammunition. The projectile is hollow and does not contain a filler.

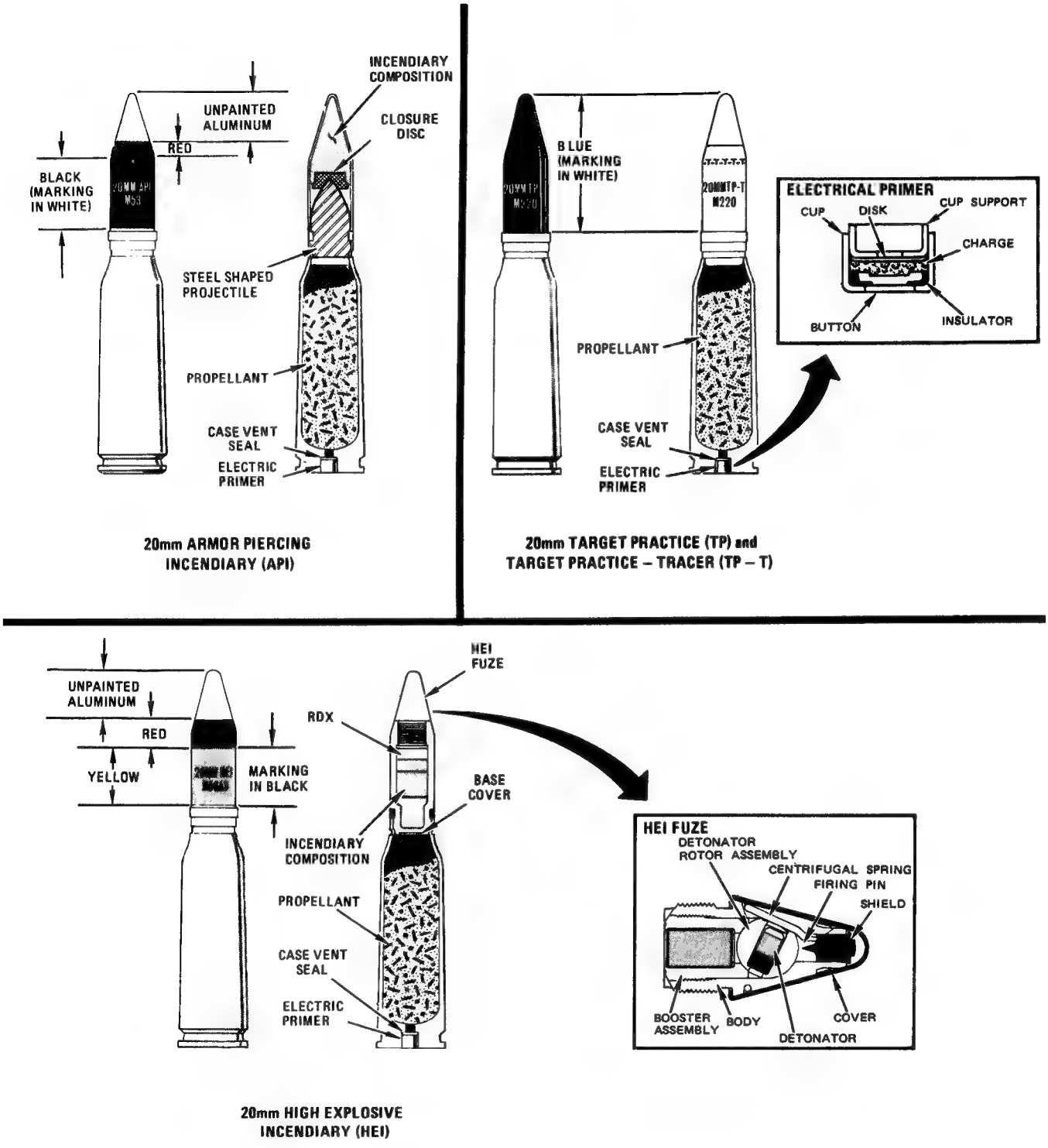
20mm Armor Piercing Incendiary

The 20mm Armor Piercing Incendiary (API) projectile (figure 1-43) is charged with an incendiary composition that functions on impact.

20mm High Explosive Incendiary

The 20mm High Explosive Incendiary (HEI) cartridge (figure 1-43) is normally used against aircraft and light material targets. The projectile explodes with an incendiary effect after it has penetrated the target. The fuze mechanisms are arranged so that the fuze is boresafe (detonator safe); the explosive train is interrupted while the projectile is still in the barrel of the gun. The fuze has a delayed arming distance of 20 to 35 feet from the muzzle of the gun. Centrifugal force, created by the projectile spin, arms the fuze and detonation occurs on impact.

20MM AMMUNITION



15C-34-1-1-(13)A

Figure 1-43

PART 5 COMBAT SUPPORT SYSTEMS

TABLE OF CONTENTS

CAMERA SYSTEM (Aircraft Thru Block 23)

DESCRIPTION

The KB-27A HUD camera system is installed forward and to the right of the HUD display unit (figure 1-44). The camera provides 16mm (motion picture) film documentation of the combined HUD symbology and the pilots forward field of view. The camera may be operated with or without the expenditure of munitions by using controls available on the camera control panel, HUD control panel and the stick grip. The system consists of the camera body, camera control panel, 100-foot capacity film magazine, and a camera periscope.

CAMERA CONTROLS AND OPERATION

HUD CONTROL PANEL

The camera is powered when either the HUD SYMBOL brightness control or the STBY RTCL control is rotated out of OFF.

Camera Switch

OFF	Inhibits camera operation.
TRIG	Allows camera operation when trigger or weapon release button is actuated.
RUN	Camera runs continuously.

CAMERA CONTROL PANEL

ASA Control

This thumbwheel control provides film speed (exposure level) selections in accordance with the type of film installed in the magazine. These selections (50 through 800) are registered on the control.

Frame Rate Switch

The frame rate switch sets the camera motor for slow speed operation (24 fps) or high speed operation (48 fps).

Camera Test Button

The camera TEST button provides a camera run signal to start the camera motor and drive the film mechanism for test purposes.

EXPSR Knob

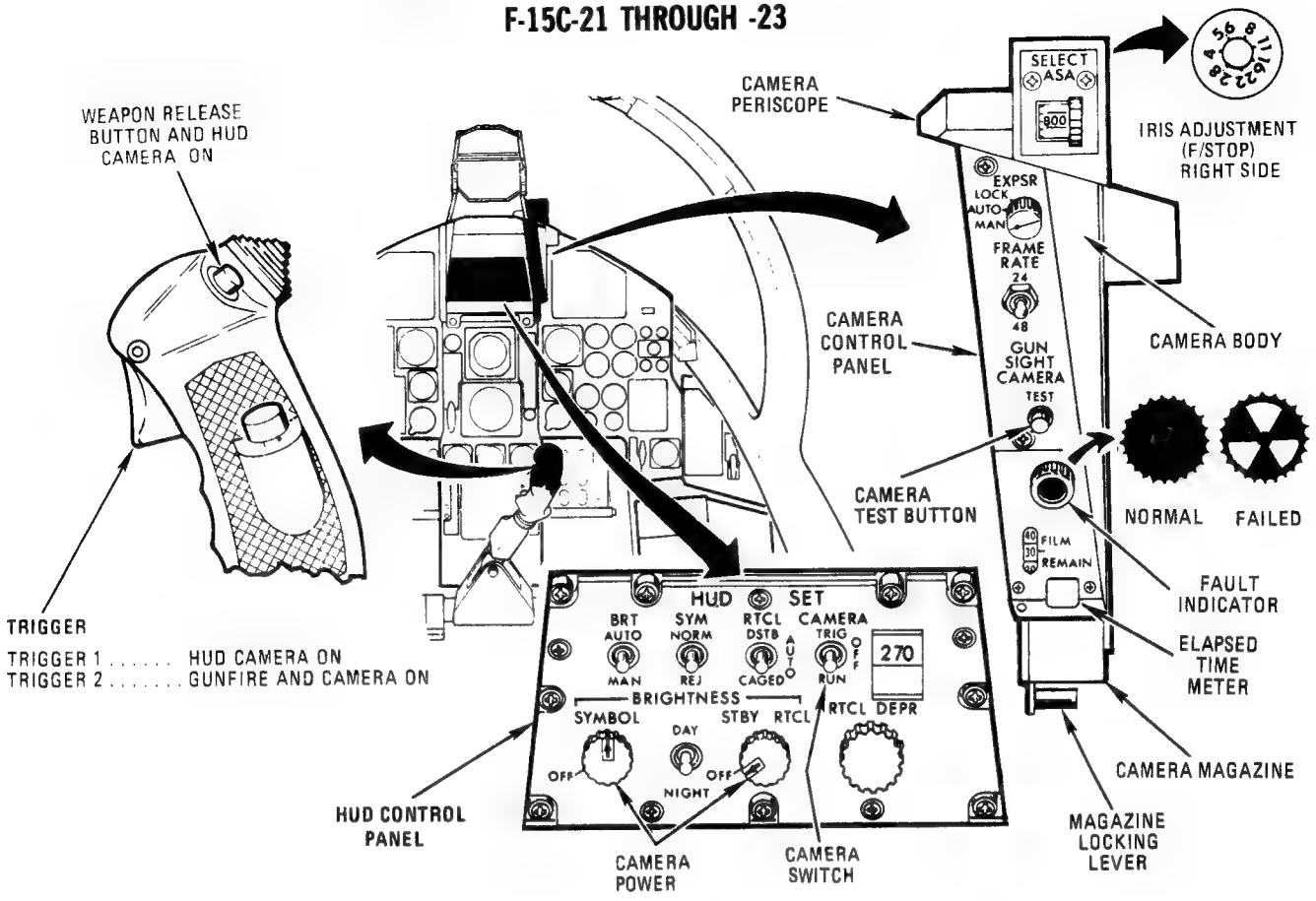
The EXPSR knob has three positions that may be selected to adapt the lens openings as follows:

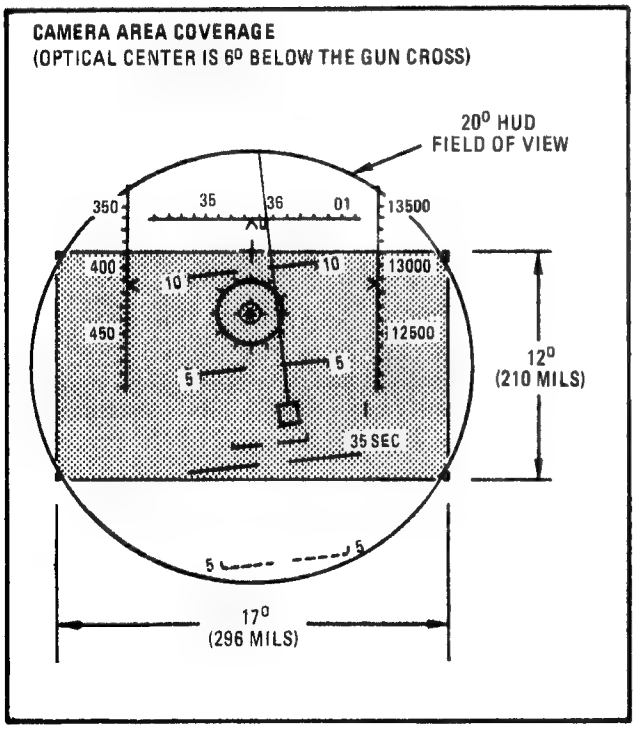
NOTE

When using either AUTO or LOCK position on the EXPSR knob, the symbol brightness knob must be ON.

HUD CAMERA & CONTROLS

F-15C-21 THROUGH -23





NOTE

- THE RECORDED VIEW OF THE HUD SCENE MAY BE DISPLACED IN ANY DIRECTION FROM PILOT'S VIEW.
- IN BLOCK 24 AND SUBSEQUENT AIRCRAFT, THE HUD CAMERA IS REPLACED BY THE VIDEO TAPE RECORDING SYSTEM. REFER TO TO 1F-15C-1.

15C-34-1-1-(73)A

Figure 1-44

LOCK	Permits the camera lens opening to vary in response to the ambient light levels until a camera ON signal is applied through the trigger, weapon release button, or the RUN position of the camera switch. Once the camera ON signal is received, the camera locks at the last opening and remains locked until a camera OFF signal is received.
AUTO	The camera lens opening continuously varies in response to the ambient light levels.
MAN	The HUD display unit is bypassed and the lens opening may be manually adjusted by using the iris adjustment knob. The MAN position must be used when using the STBY RTCL with the SYMBOL brightness knob OFF.

Fault Indicator

The fault indicator provides a status indication of the camera system circuits. When the camera continuous BIT circuit detects a camera fault, the camera fault indicator displays a black and white pattern. In addition, the HUD indicator on the BIT control panel is activated when a camera fault is detected. A no fault indication exists when the indicator is black.

Film Remaining Indicator

The film remaining indicator records the magazine film footage in increments of 10 feet.

F/Stop Control

The f/stop control provides lens openings of f/2.8 through f/22 which may be used to manually select the camera lens openings. However, the EXPSR knob must be in the MAN position before the f/stop control has any affect on the lens openings.

Trigger and Weapon Release Button

With the camera switch in TRIG and the symbol brightness knob ON, the camera begins operating when either the 1st or 2nd trigger detent is selected, or when the weapon release button is depressed. The 1st detent of the trigger is only for camera operation. The 2nd detent on the trigger operates the camera and fires the gun. The master arm switch must be in ARM to obtain camera operation with the weapon release button.

CAMERA OVERRUN PERIOD

The camera continues to operate for a short period after the trigger is released or the weapon release button is released. The overrun period is 5 seconds with the trigger, and 10 seconds with the weapon release button.

CAMERA EVENT MARKER

The event marker records the period of time that the weapon release button is held depressed or the trigger is in the second detent. Each frame of the camera film exposed during this period is marked with a light in the upper right corner of the frame.

CAMERA AREA COVERAGE

The area recorded by the HUD camera is shown in figure 1–44. The optical center of the camera is centered on the optical center of the HUD. There may be situations where the pipper is out of the camera FOV; e.g., high reticle depression angles (greater than approximately 210 mils) and in some cases during high–G air–to–air gunnery.

FILM ASSESSMENT

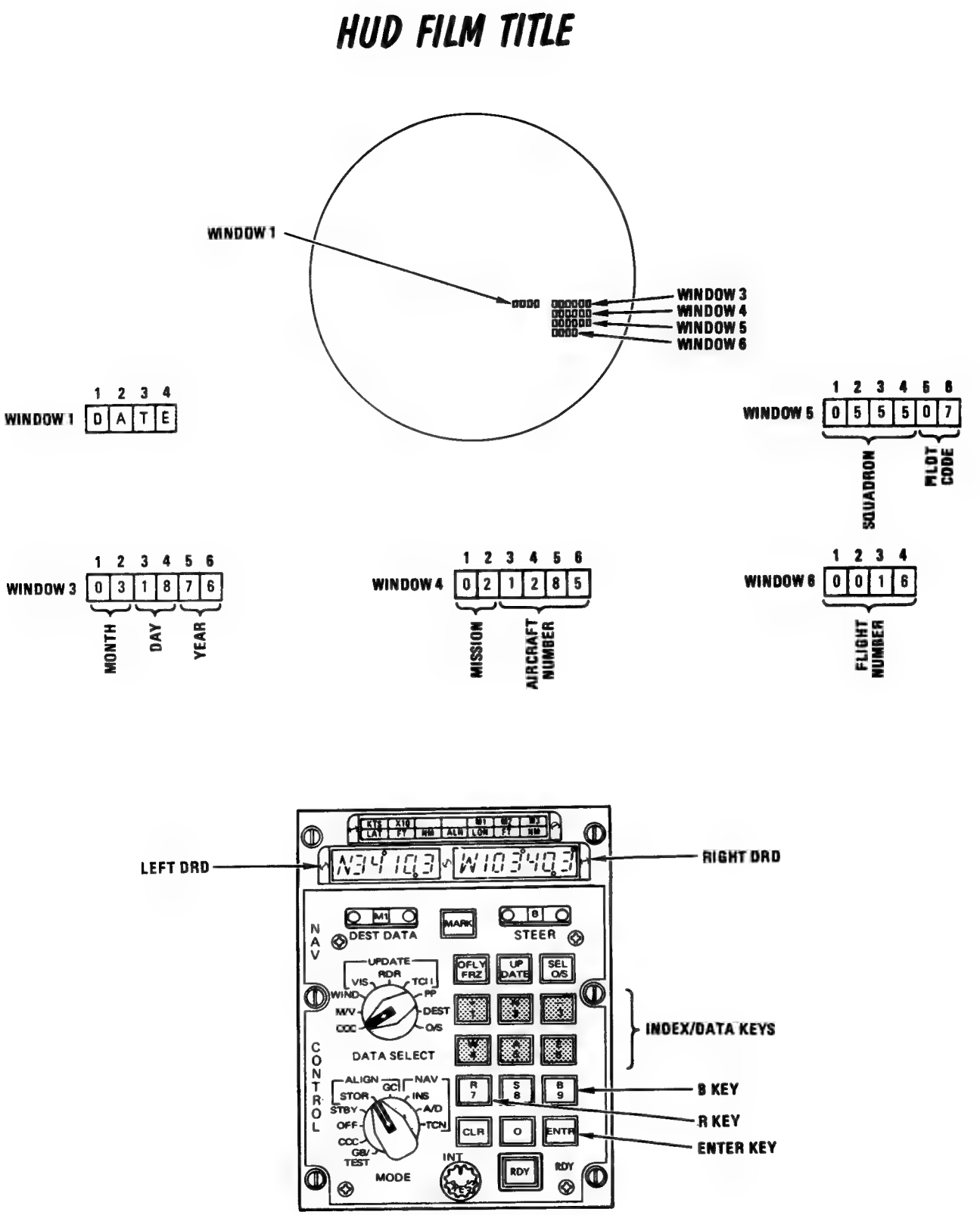
There may be an error between the camera recorded view of pipper position and the pilot's view of pipper position (figure 1–44). The magnitude and position of the error will vary between aircraft and will change when the HUD unit, camera, or aircraft windshield are changed or removed for repair. Prior to takeoff, the pilot should obtain normal head position and then record the pipper position on a distant object (1000 feet or more). This may be accomplished by positioning the camera switch in RUN and observing that the FILM REMAIN counter is moving. This procedure also checks the camera operation.

HUD FILM TITLER

The film titler provides date, mission, squadron, aircraft, pilot identification, and flight number information on the HUD display for the HUD camera to record. The title data is entered using the NCI and is controlled by the CC. When the NCI is displaying the data, the HUD film titler data is displayed in HUD windows 1, 3, 4, 5, and 6. No other window or symbology is displayed when the HUD is displaying film data. The data is recorded by placing the camera switch to the RUN position. Normal HUD displays are automatically presented when the pilot deselects M2 on the destination data counter (NCI) or CCC on the data select knob. Figure 1–45 shows an example of the film data displayed. The film title is automatically presented in a scale–up condition, regardless of the landing gear status.

Mission Data

Mission data is entered into the CC for use in the signal data recorder and is displayed on the HUD as previously mentioned. However, pilot code and flight number are not used in the signal data recorder. The program is entered by applying procedures (listed below) on the NCI panel



15C-34-1-1-(155)

Figure 1-45

(figure 1-45). The available index and mission code numbers used are shown in the lists provided.

All mission data is entered in four-digit groups except the pilot code. These groups are called up by index number. There are two sets of mission codes; the set used is dependent on whether or not the TEWS pod is aboard.

1. Dest. data counter - M2
2. Data select knob - CCC
3. Type R key and any index key
   Index number appears in the left DRD. Normally, index 1 is selected first.
4. ENTR key - PRESS
   Data stored in the selected index appears in the right DRD and all mission data appears in the HUD windows.

To enter new data -

5. Type B key, data keys, and the ENTR key.
   Entered data appears in the right DRD and the respective HUD window is updated with the new entry.

To step to the next index -

6. Update pushbutton - PRESS
   The next index and stored data appear in the DRD. Data may be changed by repeating step 5.

MISSION DATA INDICES

INDEX	DATA	EXAMPLE
1	Month, day	0318
2	Year, Mission code	8106
3	Aircraft number	0468
4	Squadron number	0555
5	Pilot code	07
6	Flight number	0016

The following table defines each mission code which may be entered in index 2 (table above).

MISSION CODES

CODE (W/O ECM Pod)	CODE (With ECM Pod)	MISSION
01	21	ACM (Guns)
02	22	ACM (Missiles)
03	23	Intercept
04	24	ACM camera only
05	25	Air-To-Ground
06	26	Instruments Navigation
07	27	Transition Proficiency
08	28	FCF
09	29	Target Tow

AIR-TO-AIR (A/A) INTERROGATOR SET

DESCRIPTION

The A/A interrogator set, in conjunction with the radar set and the VSD, provides air-to-air target identification capabilities. The interrogator set transmits challenge signals and receives target IFF replies through the L-band antennas mounted on the main radar antenna. The system evaluates the reply and generates display symbols (diamond or circle) on the VSD at the correct target range and azimuth position.

Interrogator Control Panel

The interrogator control panel (figure 1-47) contains the following controls.

MASTER CONTROL KNOB

OFF	Interrogator set is inoperative.
AUTO	Selects the MODE interrogation sequences preset in the IFF reply evaluator.
NORM	Mode of interrogation must be selected on MODE thumbwheel.
CC	Permits interrogation in MODE selected and only recognizes replies corresponding to codes selected on CODE thumbwheels.

MODE THUMBWHEEL

This thumbwheel selects interrogate modes 1, 2, 3, 4A and 4B for the NORM or CC master selections.

Figure 1-46 deleted.

A/A INTERROGATOR CONTROLS

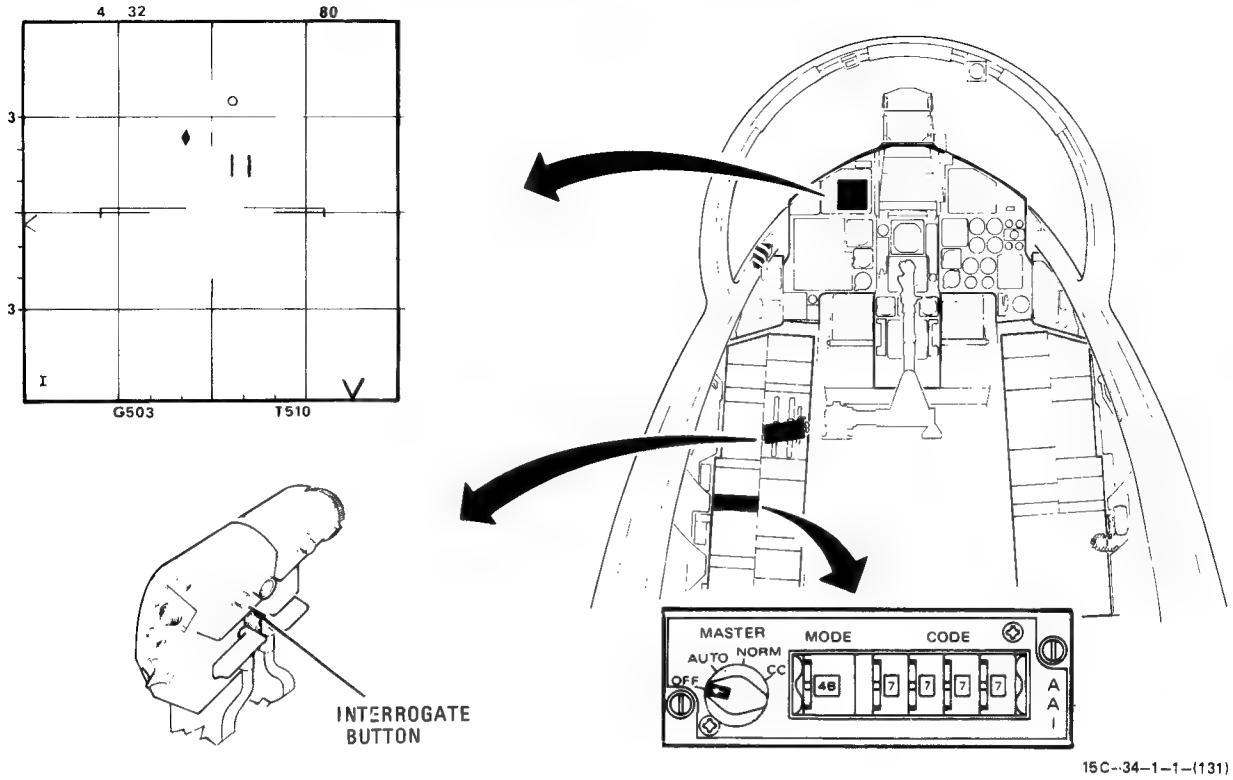


Figure 1-47

CODE THUMBWHEELS

This set of four thumbwheels selects the code to be recognized in the CC mode. Actual codes from 0000 to 7777 may be selected. The set scans the four code thumbwheel positions in all modes even though mode 1 uses only the first two digits. If the first two digits are the only codes used, the second pair of digits must be set to 00.

Interrogate Button

The interrogate button (figure 1-47) on the throttle is depressed to activate the selected interrogation modes. With the radar in search, the interrogation commences immediately and (1) continues until the button is released or (2) continues until the selected time-out period is reached or the button is released, whichever occurs first. The interrogate form obtained (1 or 2) depends on control settings accomplished on the IRE. The time-out period (in 2) is variable, and is set in terms of a number of radar scans. (More detailed information is available in TO 1F-15C-2-22.)

With the radar in track, the interrogate mode is set on the AAI control panel and the automatic mode sequence is set on the IRE. The interrogate burst (approximately 100 msec per mode) is repeated as long as the interrogate button is held.

AAI OPERATION

The AAI modes of operation are determined by the setting of the MASTER control knob. The radar may be operating in any search mode (except VS) or in track, MAP, or SNIFF mode. However, in radar MAP, PULSE, or SNIFF operations, the AAI is automatically commanded to the CC mode.

After PSP, the AAI is not automatically commanded to the CC mode in PULSE, and AAI operation is inhibited in MAP.

The VSD displays that can be obtained are as follows (figure 1-47).

DIAMOND	In MODE 1 through 3, an IFF reply. In MODE 4A or B, a low confidence (LC) IFF reply.
CIRCLE	In MODE 4A or B, a high confidence (HC) IFF reply.
I	Displayed in the VSD BIT window during interrogation signal output.

ID OFF	Displayed in the VSD BIT window when the number of IFF replies exceeds the processing capability of the system.

For the diamond or circle symbol to appear in place of a displayed target symbol, radar correlation must occur. The radar attempts to match (or correlate) the IFF reply with a target in radar memory. In radar search, correlation must occur in range and azimuth; in radar track, correlation must occur in range. When correlation occurs, the target symbol is replaced by the diamond or circle symbol.

AUTO

The AUTO mode selects the preset challenge MODE program. All IFF replies must correlate with radar targets on the VSD to be displayed. The diamond symbol is an IFF reply; a circle is a MODE 4 (crypto) HC reply.

NORM

This mode is used to identify a radar target on the VSD by MODE only. The pilot manually selects the interrogation MODE (1 thru 4A or 4B). All IFF replies must correlate with targets on the VSD to be displayed. In modes 1 through 3, a diamond symbol is an IFF reply. In MODE 4A or B (crypto), a diamond indicates an LC IFF reply and the circle is an HC IFF reply.

CORRECT CODE (CC), MODE 1 through 3

This mode is used when the target MODE and CODE are known. In radar search, all correct mode and code replies are displayed as a diamond at the proper azimuth and range whether or not radar targets were displayed. In radar track, an IFF return must correlate to replace the target symbol with a diamond.

CORRECT CODE (CC), MODE 4 (CRYPTO)

This mode is used in a hostile environment or when a positive identification of a friendly target is required. If a CC MODE 4 reply is received in radar search, the IFF symbol appears on the VSD at the correct range/azimuth whether or not a target was displayed. A diamond symbol is an LC reply; the circle symbol is an HC reply. In radar track, correlation must occur to replace the target symbol with the IFF symbol.

In PULSE, SNIFF, or MAP radar modes (before PSP), the AAI is commanded to the CC mode. The pilot may select modes 1 thru 4A or B described in the preceding paragraphs. Correlation is not possible in these radar modes and both radar and IFF targets are displayed on the VSD.

After PSP, the radar PULSE mode does not command the CC mode and AAI operation is inhibited in MAP.

All data on page 1—82 deleted.

TRAINING AND AUXILIARY SYSTEM

AIS POD, AN/ASQ-T11/T13, AIR COMBAT MANEUVERING INSTRUMENTATION SYSTEM (ACMI)

The AIS pod is the airborne portion of an ACMI training system. The pod components enable data link communication between the airplane and ACMI ground stations to document fire control system and flight information. When interrogated from the ground, the pod transmits airplane velocity, attitude, air data, and A/A weapon preparation and launch information. The ground instrumentation systems compute graphic and alphanumeric displays which are used for crew training in achieving weapon fire position.

The pod is an AIM—9 missile shape and is suspended in the same manner as the AIM—9. There are no pilot control or switching requirements; power is available for the pod as long as aircraft power is available. All ACS weapon indications function normally for SRM and MRM selections, (assuming the MRM similator plug and captive SRM are aboard). The pod will monitor MRM, SRM, GUN select and fire signals; MRM head aim and gate select; SRM cool, seeker acquisition, seeker angles and tone.

AIS POD PREFLIGHT

Specific preflight items for the AIS pod are: check the electrical connector installed; and check pod lug security in the launcher detents with the detent locking pin installed.

CARGO POD, MXU-648/A

The MXU—648/A cargo pod is a converted BLU—27 fire bomb shell. TO 16W41—2—1 provides instructions for field fabrication, repair, and cargo loading. The pod is suspended from the MAU—12 bomb rack on the inboard and CL pylons. The pod is nonjettisonable; cartridges are removed from the MAU—12 rack.

The cargo pod has a hinged access door on the left side and a removable tail cone for loading long items. A maximum of 300 pounds can be loaded into the pod. The empty weight of the pod is 125 pounds.

CARGO POD PREFLIGHT

The pilot should varify that MAU—12 cartridges are not installed, and that the MAU—12 safety pin is installed and safety wired. Pod access areas must be checked secure. Pod loading information is available in TO 1F—15C—2—2—3.

SECTION II

NORMAL PROCEDURES

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EXTERIOR INSPECTION

The Exterior Inspections (figures 2-1 through 2-4) contain munitions procedures which the pilot IS NOT REQUIRED TO PERFORM since the correct loading of suspension equipment and weapons is the responsibility of certified load crews. Exterior inspection items preceded by a star are considered SAFETY OF FLIGHT ITEMS which will be checked by the pilot.

During alert, certain safety pins may be removed, electrical cable plugs connected, and missile motor switches armed as directed by Major Command or local commander during combat conditions. Checklist items assigned to be performed in the arming area may be performed in any designated area when the aircraft is on alert status.

EXTERIOR INSPECTION

M61A1 GUN

HOT GUN

1. Ammo loaded - TYPE, QUANTITY.
2. Gun safing switch pin - INSTALLED.
3. Rounds limit counter - SET AS REQUIRED
4. Rounds limit switch - CHECK & SET (if applicable).
- ★ 5. Hydraulic manual control handle - FULL UP POSITION.

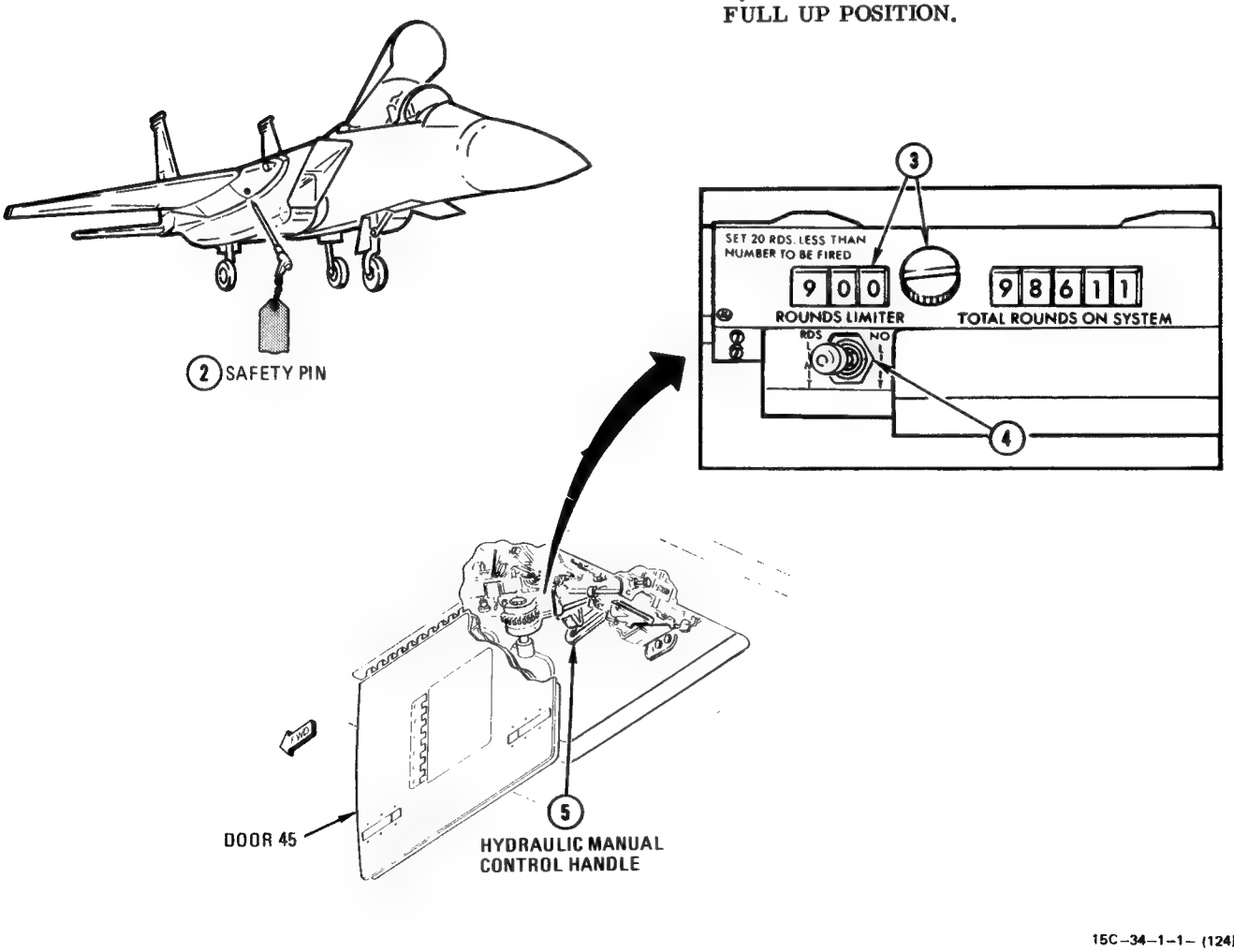
NOTE

If limiter counter is set above 799 with limit switch in LIMIT, the gun will not fire.

COLD GUN SAFING

The term "cold gun" applies to the safe status of the gun while in flight; i.e., a cold gun is loaded or partially loaded with live ammunition and is electrically and mechanically safe. When directed by mission requirements, the cold gun may be flown provided the safety of flight items (★) are accomplished.

- ★ 1. Gun safing switch pin - INSTALLED INSIDE OUT.
- ★ 2. Gun clearing cam - INSTALLED
- ★ 3. Rounds limiter - SET TO 900.
- ★ 4. Rounds limiter switch - RDS LIMIT.
- ★ 5. Hydraulic manual control handle - FULL UP POSITION.



15C-34-1-1- (124)B

Figure 2-1

EXTERIOR INSPECTION

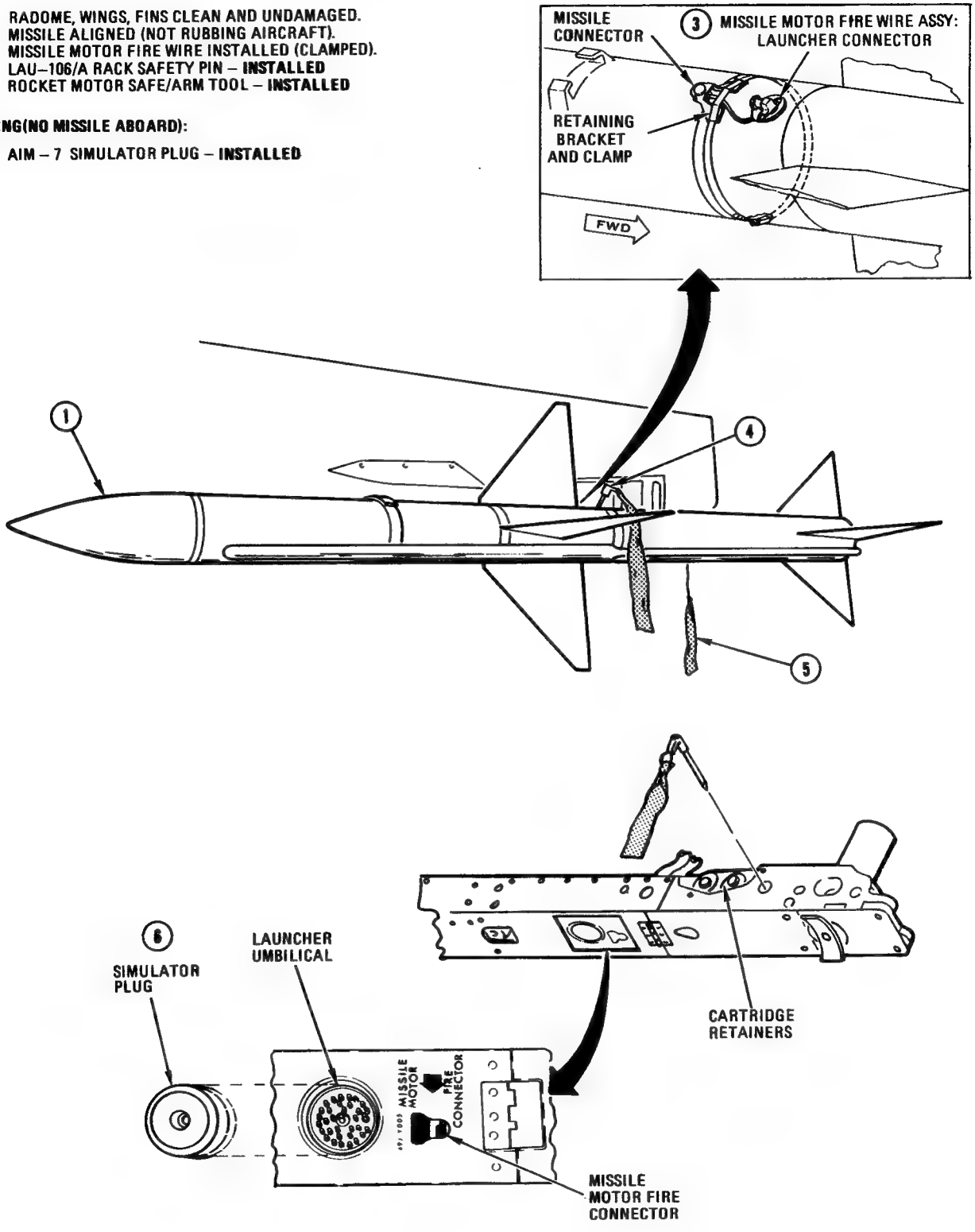
AIM-7F

LIVE MISSILE:

1. RADOME, WINGS, FINS CLEAN AND UNDAMAGED.
2. MISSILE ALIGNED (NOT RUBBING AIRCRAFT).
3. MISSILE MOTOR FIRE WIRE INSTALLED (CLAMPED).
4. LAU–106/A RACK SAFETY PIN – **INSTALLED**
5. ROCKET MOTOR SAFE/ARM TOOL – **INSTALLED**

TRAINING(NO MISSILE ABOARD):

6. AIM – 7 SIMULATOR PLUG – **INSTALLED**



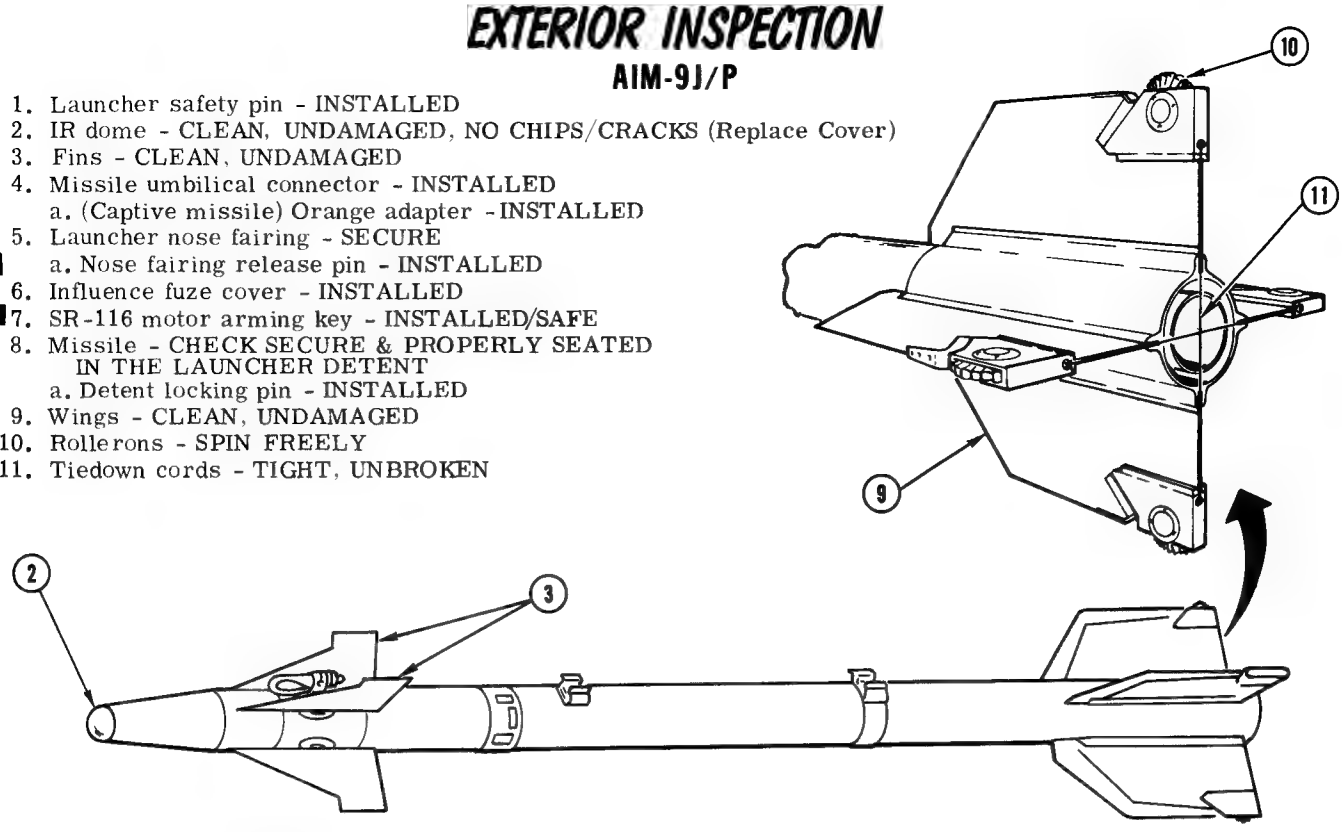
15C–34–1–1–(163)

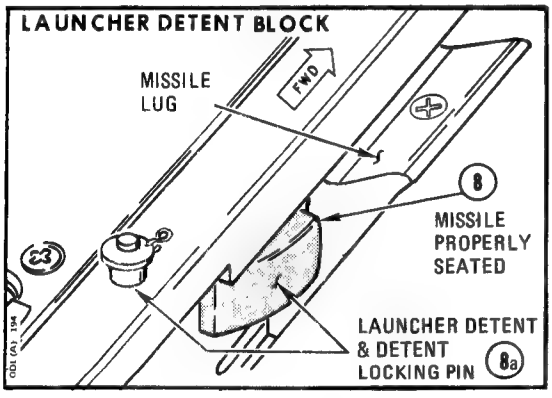
Figure 2–2

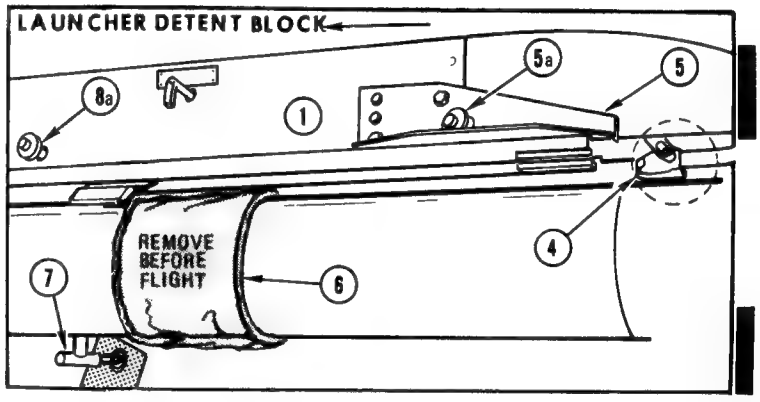
EXTERIOR INSPECTION

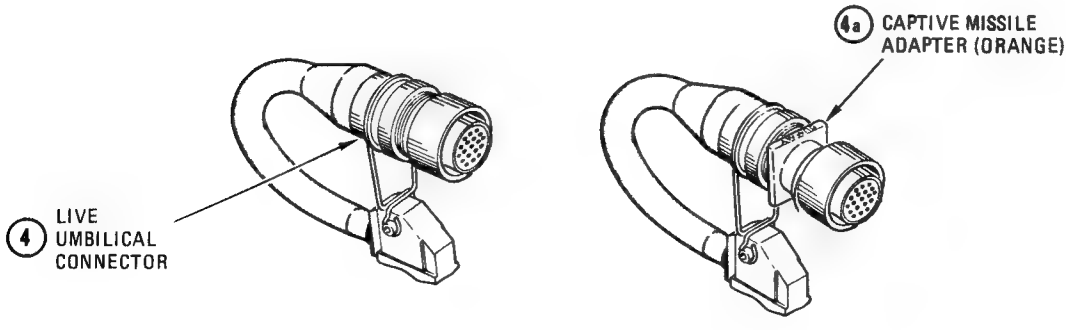
AIM-9J/P

1. Launcher safety pin - INSTALLED
2. IR dome - CLEAN, UNDAMAGED, NO CHIPS/CRACKS (Replace Cover)
3. Fins - CLEAN, UNDAMAGED
4. Missile umbilical connector - INSTALLED
   a. (Captive missile) Orange adapter - INSTALLED
5. Launcher nose fairing - SECURE
   a. Nose fairing release pin - INSTALLED
6. Influence fuze cover - INSTALLED
7. SR-116 motor arming key - INSTALLED/SAFE
8. Missile - CHECK SECURE & PROPERLY SEATED IN THE LAUNCHER DETENT
   a. Detent locking pin - INSTALLED
9. Wings - CLEAN, UNDAMAGED
10. Rollerons - SPIN FREELY
11. Tiedown cords - TIGHT, UNBROKEN









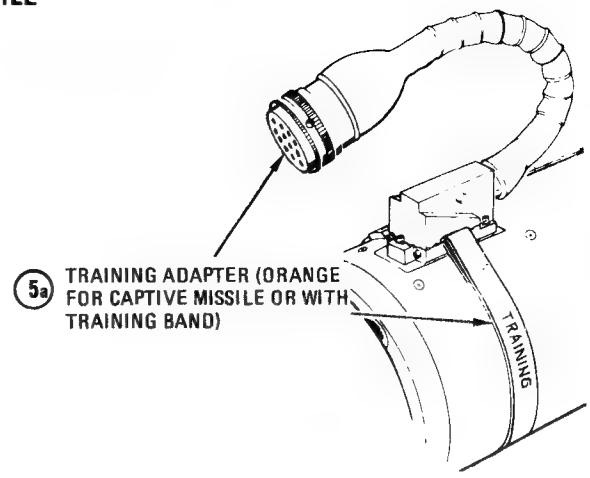
15C-34-1-1-(162)F

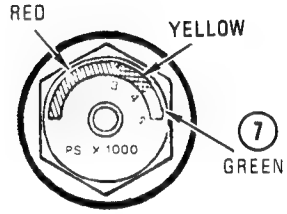
Figure 2-3

EXTERIOR INSPECTION

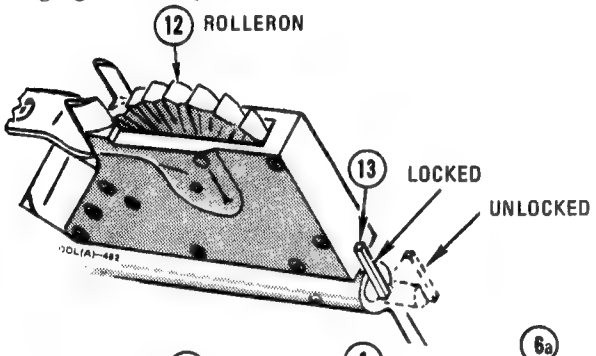
AIM-9L MISSILE

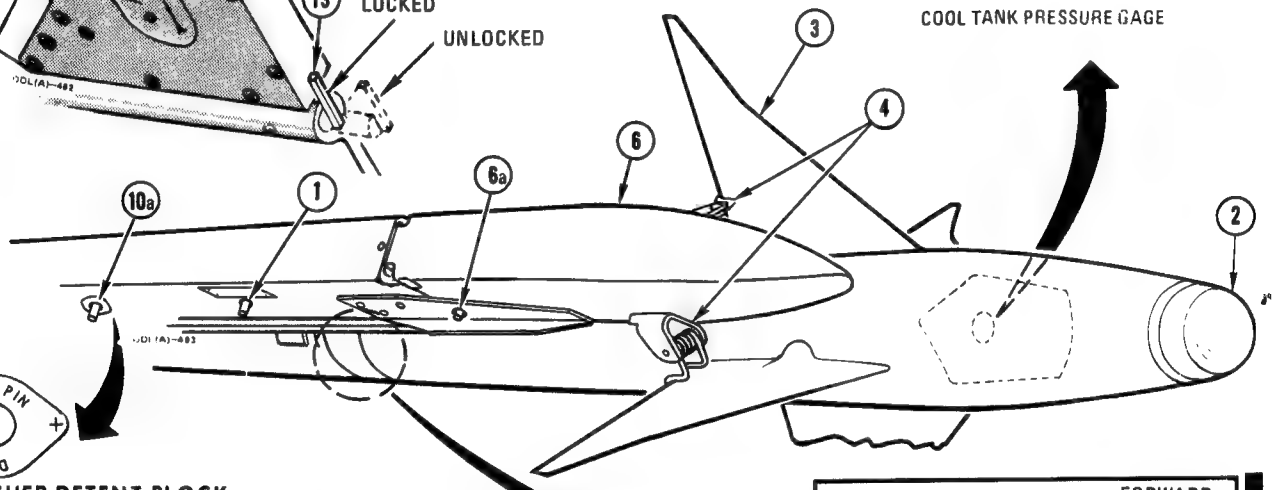
1. Launcher safety pin - INSTALLED
2. IR dome - CLEAN, UNDAMAGED, NO CHIPS/ CRACKS (Replace cover)
3. Fins - CLEAN UNDAMAGED
4. Fin retaining springs - ENGAGED ON FINS
5. Umbilical plug - CONNECTED TO LAUNCHER
   a. Training missile - ORANGE, OR BLACK with BLUE TRAINING CLAMP
   b. Live missile - BLACK
6. Launcher nose fairing - SECURE
   a. Nose fairing release pin - INSTALLED
7. Coolant tank pressure gage - CHECK
   a. For combat - IN GREEN AREA
   b. For training - OUT OF RED AREA
8. Target detector cover - INSTALLED
9. MK36 Mod 8 motor arming key - INSTALLED/SAFE
10. Missile - CHECK SECURE AND PROPERLY SEATED IN THE LAUNCHER DETENT
    a. Detent locking pin - INSTALLED
11. Rear wings-CLEAN,UNDAMAGED
12. Rollerons - SPIN FREELY
13. Caging assembly - LOCKED



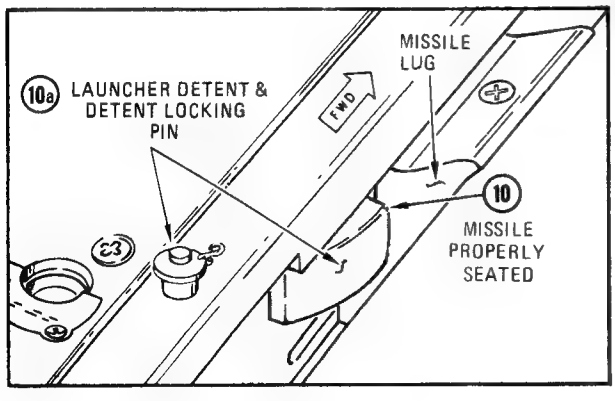


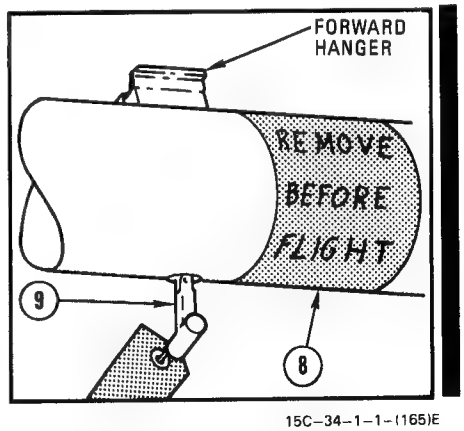
COOL TANK PRESSURE GAGE





LAUNCHER DETENT BLOCK





15C-34-1-1-(165)E

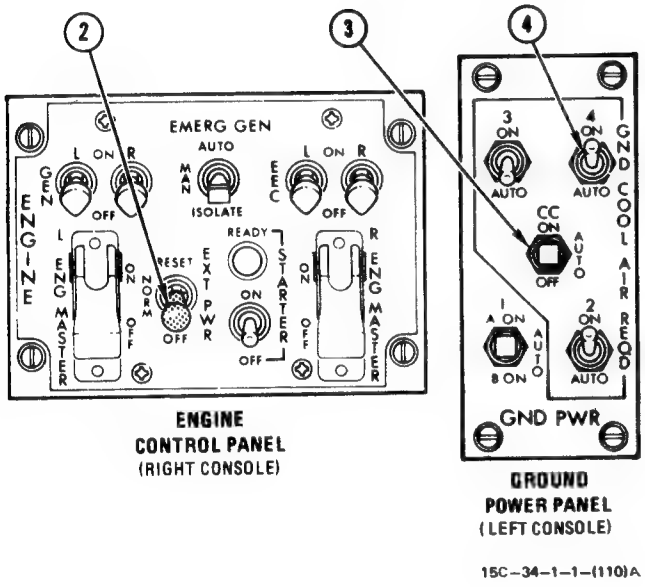
Figure 2-4

INTERIOR INSPECTION

EXTERNAL POWER

1. Cooling air – CHECK APPLIED (ECS light OFF)
2. Engine control panel (figure 2–5) EXT PWR switch – RESET
3. Ground power panel (figure 2–5), CC switch – ON
4. Ground power panel, switch 4 – ON

ENGINE & GROUND CONTROL PANELS



ENGINE CONTROL PANEL (RIGHT CONSOLE)

GROUND POWER PANEL (LEFT CONSOLE)

Figure 2–5

ARMAMENT CONTROL PANEL

1. Master arm switch – SAFE
2. Rounds remaining – SET
3. Gun rate switch – HIGH or LOW
4. MRM station windows – MRM
5. SRM station windows – SW

HUD SETUP

1. RTCL switch – AUTO
2. SYM switch – NORM or REJECT (As required)
3. BRT control – AUTO or MAN (As required)
   Use MAN at night.
4. Day/night switch – AS REQUIRED
5. Symbol knob – ON (clockwise)
   a. Adjust brightness if BRT control is in MAN
6. HUD camera switch – OFF

CAMERA SETUP

1. Magazine – INSTALL (If required)
   a. Slide magazine upward into magazine recess area with bottom of magazine tilted outward to clear latch arm.
   b. As top of magazine seats against camera body, use light finger pressure to push bottom of magazine against camera mount plate.
   c. Allow magazine to drop downward slightly until it bottoms against latch.
   d. Place thumb against short face on bottom of magazine and push upward. With thumb in place, pull lock lever (toward pilot) using index finger. When lever snaps overcenter, the magazine is locked in place.
2. Camera ASA control – SET AS REQUIRED
3. Camera EXPSR knob – SET AS REQUIRED
4. Camera frame rate switch – 24 or 48
5. If step 3 is MAN, set f-stop (right side)
6. HUD camera switch – TRIG

NOTE

- The pilot may check the camera by briefly selecting RUN on the HUD camera switch or by momentarily pressing the camera TEST button and observing the movement of the film remaining counter.
- The symbol brightness knob must be ON to obtain camera operation through the weapons release button or trigger when using the standby reticle.

VSD TURNON

1. Rotate BRT knob – CLOCKWISE (Desired level)
2. Rotate symbol brightness knob – CLOCKWISE (Desired Level)
3. Contrast switch – AUTO/MAN (As required)

RADAR TURNON

1. Radar power knob – STBY (start 3–minute warmup)
2. Set radar parameters.
   a. Range – 40
   b. El scan – 2
   c. Az scan – 120

d. Frame store – 2
e. Special mode – OFF
f. Mode control – MAN
g. Mode selector – LRS
h. Antenna El (throttle) – 0°

To read BIT matrix (after 3–minute warmup)

3. BIT system knob – RDR
4. BIT initiate button – PRESS
   a. VSD BIT window – G–TEST
      On the ground, the G–TEST readout verifies the WOW interlock.

NOTE

If it is unnecessary to read the matrix, proceed to step 5 or momentarily press auto acquisition REJECT.

   b. After 3 seconds, VSD BIT window reads I–BIT followed by I–BIT matrix.

NOTE

The I–BIT matrix readout is bypassed if the previous initiated BIT was aborted.

   c. After I–BIT matrix, VSD BIT window reads CM–BIT followed by CM–BIT matrix.
   d. After CM–BIT matrix, VSD BIT window – 13 MDC
   e. After 7 seconds, VSD BIT window – 14 ( )
   f. After 7 seconds, BIT window – EL SCAN/PRF
5. Radar power knob – OPR
   a. VSD range window reads VS during MRM tuning. When tuning is complete, range window reads 40. ACP MRM station window goes from MRM to STBY for stations with missile aboard.

NOTE

If any missile does not tune, the MRM station indicator shows MRM and that station is automatically dropped from the firing sequence. To initiate another tuning cycle, place radar power OFF for 15 seconds, then return to OPR. The 3–minute warmup period is reinitialized.

To perform the I–BIT (if desired):

6. BIT initiate button – PRESS
   a. RDR light blinks
   b. VSD BIT window – G–TEST (TEST when airborne)
   c. After 3 seconds, VSD BIT window – TK TST

To initiate track test:

7. While VSD reads TK TST (7 seconds only) auto acquisition switch – FWD or AFT
   a. Observe proper test displays in all search modes. Perform acquisition and lockon tests as required (See Section I, Radar BIT System).
8. After track tests, BIT initiate button – PRESS
   a. VSD BIT window reads G–TEST and I–BIT starts (approx 2 minutes).

NOTE

A steady illumination of the RDR BIT light indicates a radar malfunction. The failure data is recorded in the I–BIT matrix. The I–BIT may be terminated anytime by selecting auto acquisition REJECT; NO BIT is displayed in the BIT window for 7 seconds.

ARMAMENT AREA - ARMING

1. Master arm switch - SAFE
2. Pilot - HANDS IN VIEW
   The pilot will place both hands in view as a signal to the load crew to approach the aircraft, remove all safety pins, install all access covers, and perform any final aircraft/weapon preparations immediately prior to launch.
3. Radar power knob - OPR (If required)
4. MRM - CHECK TUNED (If required)
   a. MRM station indicator - STBY

AIR-TO-AIR ATTACK - INFLIGHT

PREATTACK

1. Radar power knob - OPR
2. Radar controls - AS DESIRED
3. A/G, ADI, VI master mode buttons - OFF
   Deselect any illuminated master mode button, or move throttle weapon switch to GUN (aft).
4. Missile status - CHECK
   a. MRM stations - STBY
   b. SRM stations - STBY OR SW
      The SRM in priority will indicate STBY when SRM is selected on the throttle weapon switch. All other SRM stations should indicate SW.
   c. (AIM-9L) First option window - COOL
      Cool option can be selected.
5. Gun rate switch - AS DESIRED

MRM ATTACK

A HI PRF radar track is desired prior to MRM launch. With full track, launch when target range is between Rmax and Rmin (Refer to TO 1F-15C-34-1-1-1), the IN RNG cue is ON and the steering dot is within the ASE circle. (Steering dot should be at or near ASE center). After launch, maintain track until impact or zero Tgo. If lockon is not possible, fly to keep target within the HUD MRM circle. After launch, keep target within the FLOOD circle until impact.For additional FLOOD launch informaton, refer to TO 1F15C-34-1-1-1.

MRM LAUNCH

1. Throttle weapon switch - MRM (forward)
2. Master arm switch - ARM
   a. MRM station in priority - RDY

CAUTION

If more than one MRM station window indicates RDY, do not launch. More than one missile may launch simultaneously.

3. PRF - HI (if tracking)
   The radar will not switch to HI PRF (even with master arm switch in ARM) while tracking at short ranges with near zero overtake. In this situation, the pilot should establish either an opening or closing rate that is greater than 30 knots to cause the radar to switch to HI PRF.
4. Weapon release button - PRESS
   a. Launched MRM station - DASH
   b. Next MRM station in priority - RDY

To ripple launch two MRM's -

5. Weapon release button - RELEASE, PRESS AGAIN, AND HOLD
   Hold second launch signal until first missile fires (1.6 SEC).

AIM-9J/J-1/P/P-1 SRM ATTACK

Radar lockon should be accomplished if possible. In attacks following front aspect MRM launch, the VI mode can be selected to provide conversion steering for an SRM attack. Follow VI steering and/or fly to center the TD symbol (HUD) or steering dot (VSD) in the SRM reference circle. Target detection is indicated by the detection tone. Launch when radar range is between Rmax and Rmin with the tone ON. Without lockon, estimate the launch envelope and target aspect criteria; launch when the missile tone is ON.

AIM-9J/J-1/P/P-1 SRM LAUNCH

1. Throttle weapon switch - SRM (center)
   a. SRM station in priority - STBY
2. Master arm switch - ARM
   a. SRM station in priority - RDY
3. Target detection tone - MONITOR
4. Nose gear steering button - PRESS AND RELEASE (if uncaging is desired)
   a. SRM circle - OFF
5. Weapon release button - PRESS
   a. Launched SRM station - DASH
   b. Next SRM station in priority - RDY

To reject an SRM –

1. SRM reject button – PRESS
   a. SRM station in priority – RDY

AIM-9L SRM ATTACK

Radar lockon should be accomplished if possible. This slaves the priority missile seeker directly to the target. Ensure cooling is selected at least 25 seconds prior to firing. Center the steering dot in the ASE circle (radar lockon). Retain or rescind nutation as required to obtain target detection. Launch the missile when target range is within Rmax and Rmin limits and the seeker is providing either the target detection steady tone or chirp (self track) tone.

When radar lockon is not available, center visual target within seeker FOV reference circle and obtain seeker detection tone. Select cooling and rescind or retain nutation as required. Launch missile when within estimated launch envelope and seeker is providing either the detection steady tone or the chirp tone.

AIM-9L SRM LAUNCH

1. Throttle weapon switch – SRM (center)
   a. SRM station in priority – STBY
   b. Second monitor window – SCAN
      Scan can be deselected.
2. Master arm switch – ARM
   a. SRM station in priority – RDY
   b. First monitor window – COOL
      Cooling must be initiated prior to missile launch; it is automatically selected at master ARM.
3. Target detection tone – MONITOR
   a. Adjust volume for acceptable level.
4. Nose gear steering button – PRESS/RELEASE (if lockon is desired)
   a. ASE circle expands (with radar lockon) or FOV circle disappears (without radar lockon).
   b. Missile tracking (chirp) tone – ON.
5. Weapon release button – PRESS
   a. Launched SRM – DASH
   b. Next priority SRM – RDY

To reject an SRM –

6. SRM reject button – PRESS
   a. New priority SRM – RDY

GUN ATTACK

Attempt radar lockon with any of the methods described in section I. With no radar lockon, the reticle fixed range input is 2250 feet. With the reticle stiffened (with or without radar lockon) the fixed range is 1000 feet.

1. To get gun steering, throttle weapon switch – GUN
2. Master arm switch – ARM

NOTE

With a cold gun, confirm an XXX indication on the HUD.

3. Trigger – SECOND DETENT

WARNING

Unscheduled gun stoppage during firing constitutes a possible hazardous condition and is cause to terminate gun operation for remainder of the flight. Stoppages can be caused by malfunctions such as rupture of round cartridge cases and consequent dispersal of gun powder in gun compartment. Further operation of the gun after a stoppage could make a hazardous condition worse or cause a minor problem to develop into a hazardous condition.

WEAPON SAFE

1. Master arm switch – SAFE
   a. HUD cross – OFF
   b. MRM stations – MRM
   c. SRM stations – STBY/SW

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All data on page 2–10 deleted.

SECTION III

EMERGENCY PROCEDURES AND ABNORMAL OPERATIONS

TABLE OF CONTENTS

EMERGENCY PROCEDURES

JETTISON PROCEDURES

With the exception of stores that are designated nonjettisonable, the pilot may use the aircraft jettison system to jettison all externally mounted stores or pylons. The pilot may jettison each station individually or jettison multiple stations as the situation requires. The jettison controls are described in section I and the jettison procedures are illustrated on the Jettison Chart, figure 3—1.

'UNG ORDNANCE

Hung ordnance is the term used when an unsuccessful attempt has been made to release or jettison a weapon from the aircraft; the HUNG cue appears in the missile store inventory. In the event an SRM HUNG indication occurs, there is no way to reinstate that SRM into the launch circuit. Considering the MRM, the ACS will allow a HUNG missile to be reinstated into the firing order by cycling the radar power knob from OPR to OFF and return. However, there is no chance of success and attempting the procedure will cause extensive damage to the HUNG missile.

CAUTION

Attempting to reinstate a HUNG MRM into firing order will cause extensive damage to the missile.

FIRE FIGHTING AND EVACUATION

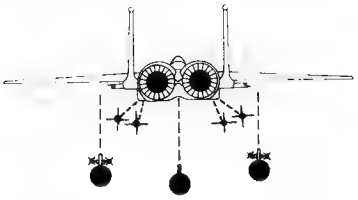
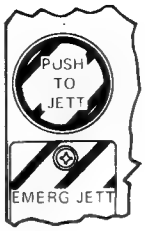
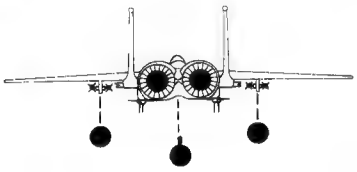
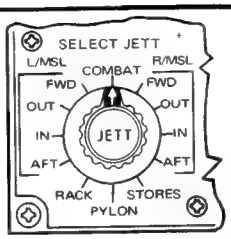
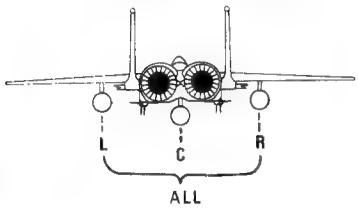
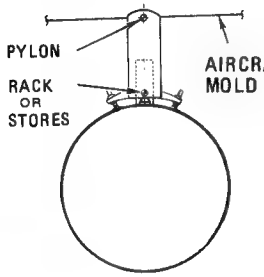
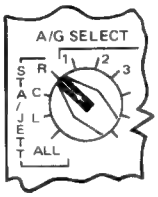
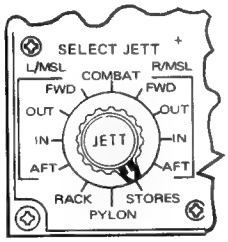
Aircraft fires involving conventional munitions cannot be definitized to any one set of circumstances and environmental conditions. This precludes development of reliable standardized test criteria and reliable specific item fire fighting and withdrawal times. The conclusion to be reached from available data is that munitions reaction to fire is a function of case thickness and type of explosive filler which can vary due to environmental conditions. Since the circumstances of a fire cannot be predicted, specific item by item fire fighting and withdrawal times cannot be determined with any degree of reliability.

Normally, aircraft fires involving muntions will occur under a set of circumstances wherein it will be impossible to know immediately the specific missile, bomb, or CBU model number. Such information is absolutely essential for specific fire fighting and withdrawal times. Therefore, these times are presented only for bombs, CBUs, rockets, or missile family groups. (Refer to TO 1F—15C—34—1—2 for bomb, CBU, and rocket munitions.)

a. Missiles: Missiles normally react in propulsion, detonation, or both between 45 seconds and 2 minutes. A propulsion hazard (missile flight) exists within 45 seconds and a major hazard to environment and fire fighting capability after 2 minutes. Approach the fire, if necessary, from the side of the aircraft.

The fire fighting guidance provided in AFR 127—100 will be utilized in all instances. There is no specific withdrawal time assigned for items which do not align to one of the four family groups.

JETTISON CHART

EMERGENCY JETTISON	JETTISON CONTROL	PROCEDURE	LOCATION
 ALL STATIONS	 [1] [4] EMERGENCY JETTISON BUTTON	PUSH	MAIN INSTRUMENT PANEL
COMBAT JETTISON			
 LEFT, CENTERLINE AND RIGHT WING ONLY	 [2] [3] [4] SELECT JETT ROTARY KNOB	1. SELECT COMBAT AND 2. PUSH JETT BUTTON	ARMAMENT CONTROL PANEL
SELECTIVE JETTISON, STATIONS 2, 5, AND 8			
 ALL 	 A/G SELECT [3] [4]  SELECT JETT	1. SELECT STA JETT R, C, L OR ALL 2. SELECT JETT PYLON, RACK OR STORES 3. PUSH JETT BUTTON	ARMAMENT CONTROL PANEL

[1] SWITCH IS HOT WITH INTERNAL OR EXTERNAL POWER APPLIED.
[2] WING STATION PYLONS, AIM–9 AND AIM–7 MISSILES DO NOT JETTISON.
[3] LANDING GEAR HANDLE UP OR OVERRIDE SELECTED.
[4] APC STATION INDICATORS FUNCTION AS IN NORMAL RELEASE.
[5] AFTER TO 11L1–2–14–502, SELECTIVE AIM–9 MISSILE JETTISON FROM LAU–114/A LAUNCHER IS DISABLED.

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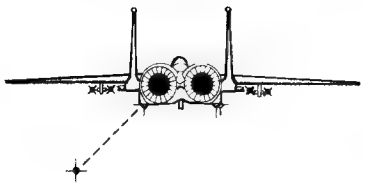
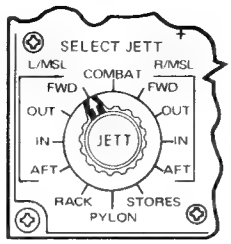
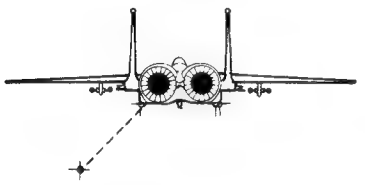
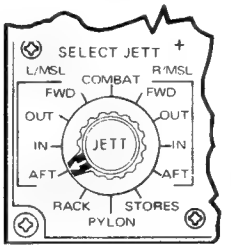
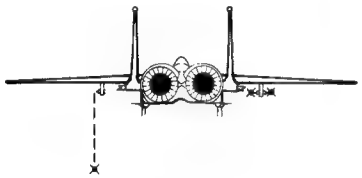
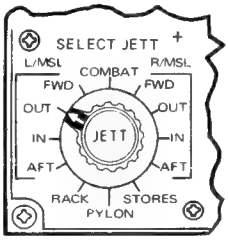
Figure 3–1 (Sheet 1 of 2)

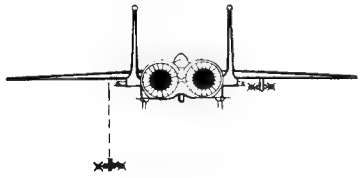
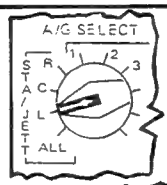
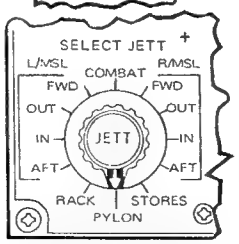
JETTISON CHART (*Continued*)

AIM-7 SELECTIVE JETTISON	JETTISON CONTROL	PROCEDURE	LOCATION
 LEFT FORWARD MISSILE	 3 4 SELECT JETT KNOB	1. SELECT L/MSL FWD AND 2. PUSH JETT BUTTON 3. REPEAT 1 & 2 FOR RIGHT SIDE	ARMAMENT CONTROL PANEL
 LEFT AFT MISSILE	 3 4 SELECT JETT KNOB	1. SELECT L/MSL AFT AND 2. PUSH JETT BUTTON 3. REPEAT 1 & 2 FOR RIGHT SIDE	

AIM-9 SELECTIVE JETTISON (Before TO 11L1-2-14-502)

	 3 4 SELECT JETT KNOB	1. SELECT L/MSL OUT OR IN AND 2. PUSH JETT BUTTON 3. REPEAT 1 & 2 FOR RIGHT SIDE	ARMAMENT CONTROL PANEL

AIM-9 JETTISON (After TO 11L1-2-14-502)

	 A/G SELECT  3 4 SELECT JETT KNOB	1. SELECT STA JETT R OR L 2. SELECT JETT PYLON 3. PUSH JETT BUTTON	

15C 34-1-1-(102-2)C

Figure 3-1 (Sheet 2)

ABNORMAL OPERATIONS

A/A FAILURE MODES

RADAR FAILURE

False Targets (birds)

1. Change channel
2. If false targets remain, INS may be in error. First confirm that the INS is in error, then try the A/D mode.
3. Select radar STBY and read the CM–BIT.
4. Perform the I–BIT.

Radar BIT Light (BCP) Illuminates

1. Cycle radar power knob – STBY TO OPR
   Select STBY and back to OPR to attempt to extinguish the radar BIT light.
2. If radar BIT light remains ON – CHANGE CHANNEL
   Attempt to find an operating channel, if any.
3. If radar BIT light remains ON – CHANGE MODE
   If changing channels doesn't achieve normal operation, change radar mode to determine which (if any) modes are operational.
4. If radar BIT light remains ON, perform I–BIT. If radar BIT light still remains ON, a positive radar failure can be assumed.

The loss of valid radar information does not inhibit the employment of any A/A weapon. For the MRM, at least the FLOOD mode must be available. Refer to TO 1F-15C-34-1-1-1. For the SRM, the visual/optical tracking method must be utilized. GUN mode lead–compute steering is available for the fixed range of 2250 feet or the reticle stiffened range of 1000 feet.

NOTE

The velocity vector flashes if the ADC or INS fails, or if the pilot selects air data (A/D) on the NCI mode switch.

Radar Fails to Enter MRM Tune Mode

This problem can be caused by an improper radar shutdown procedure. The flight manual requires that the radar be turned OFF prior to engine shutdown. If the converse occurs, the stated problem can occur on the next flight (TUNE cue does not appear in VSD window 1). The situation can be corrected by cycling the radar power knob to OFF and to OPR, which initiates another tune sequence (after 3—minute STBY).

RF No Go

In the event this indication occurs (VSD BIT window), there is no MRM capability unless the situation can be corrected by trying other channels. RF NO GO will not prevent MRM launch; the only requirement for MRM launch is that the missile must have (at one time) been tuned, and RDY achieved in the ACP monitor. Once this is done, an MRM will launch (ballistic), regardless of the status of the radar.

If RF NO GO occurs when radar OPR is selected initially, the MRMs will attempt tune unsuccessfully. If NO GO is subsequently corrected, the pilot must reinitiate MRM tuning by cycling radar power to OFF and to OPR.

Radar Hot Light (Inflight)

1. Radar power knob – OFF
   If continued use of the radar is critical, place the power knob OFF as soon as the situation permits.

INS INFLIGHT FAILURE

In case of an INS inflight failure, backup attitude, heading, and velocity data is provided by the AHRS and ADC (figure 3—3). Groundspeed is obtained by using AHRS and ADC inputs and the computed winds prior to INS failure. All A/A weapon steering modes may continue acceptable operation because a clutter tracker is present in the radar processor during MED PRF search. Clutter rejection may be degraded when transitioning between weapon modes because the clutter tracker is initially positioned with the INS velocity inputs. After an INS failure, the radar uses CC velocities based upon true airspeed and computed winds. If false radar targets become objectionable, switch to the A/D mode and insert best estimate of winds.

INS FAILURE TO FULLY ALIGN BEFORE TAKEOFF

Tactical considerations may dictate aircraft takeoff before the INS is fully aligned. After BATH alignment, all A/A weapon steering modes will continue acceptable operation for the same reasons stated in the preceeding paragraph. If false targets become objectionalbe in some lookdown geometries, switch to the A/D mode and insert estimated winds.

CC FAILURE

All MRM and SRM attack steering display data is lost if a CC failure occurs. With radar lockon, only the radar data displayed on the VSD may be used for target steering: the target symbol and antenna azimuth caret for range and bearing; and the antenna elevation caret for elevation. The simulated doppler input is available for the MRM from radar range rate, but all other CC inputs (english bias, head aim) are absent. The pilot must therefore use boresight steering and estimate an MRM launch point, or close and attempt to get the SRM tone.

In GUN mode with CC failure, the LCG switches to the secondary mode and performs the total computation of gunnery lead angles. If the radar is not tracking, the LCG uses a fixed range of 1000 feet. With radar track, normal lead compute steering is flown using the gun reticle and the range bar. The lag line and bullet Tf cue are not available.

MASTER ARM SWITCH FAILURE

A master arm switch failure can occur in which the pilot is unable to safe the weapon system.

WARNING

If the HUD gun cross remains visible after selecting master arm SAFE, the weapon release button and trigger switch circuits are ARMED.

To SAFE the weapon release button, select the A/A master mode/gun steering on the throttle weapon switch. This inhibits MRM/SRM missile launch and inhibits any A/G weapon release program that may have been selected. On the ACS, the fifth (RDY) monitor should show a dash. If A/G stations had been selected, deselect the stations (dash in the station indicators). The trigger switch must be avoided; the gun fire circuit remains HOT. When the landing gear handle is placed down for landing, the gun cross should be observed OFF.

LOSS OF HUD SYMBOLOGY

A power transient may cause loss of HUD symbology which can be restored by cycling the symbol brightness knob to OFF, then back to ON.

CAMERA FAULT

The pilot should not remove the camera magazine from the camera when a camera FAULT is indicated, or when the FILM REMAINING indicator fails to move during camera operation. The magazine must remain with the camera to isolate the camera malfunction.

A/A FUNCTIONAL SIGNAL FLOW DIAGRAM

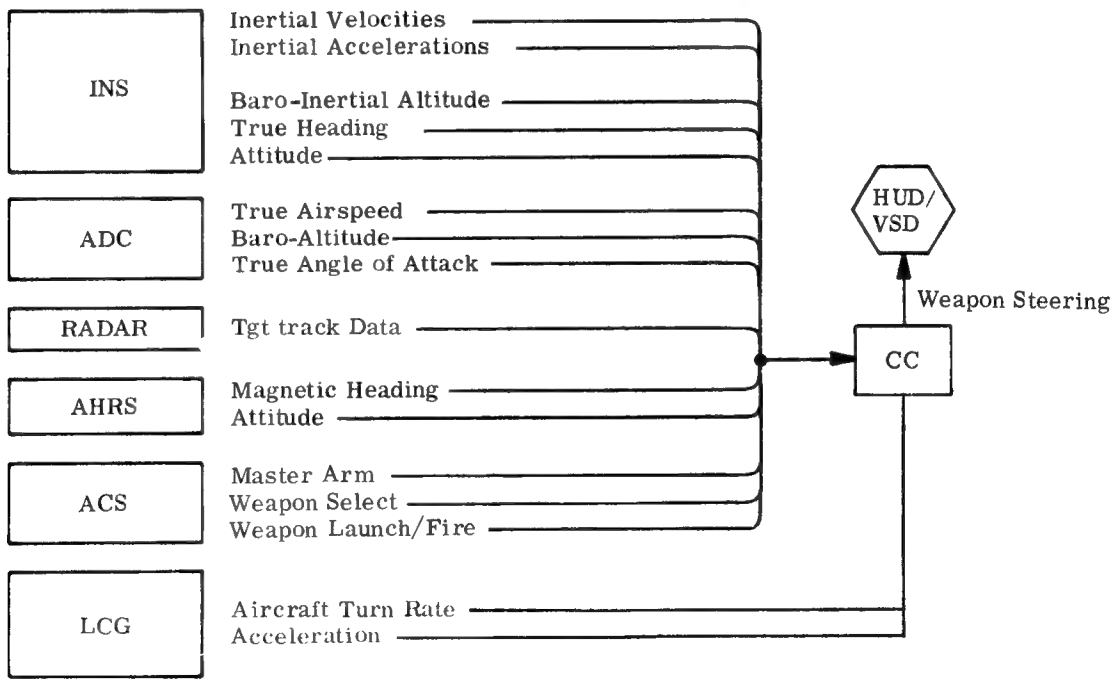


Figure 3-2

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A/A DATA PARAMETERS & SOURCES

Parameter	Primary Source	Primary Data Used When	Secondary Source	Secondary Data Used When
Pitch, Roll	INS	INS Data Valid	AHRS	AHRS Valid and INS Invalid
True Heading	INS	INS Data Valid	AHRS plus Mag. Var.	AHRS Valid and either INS Invalid or A/D Nav. Selected & Pilot Entry of Mag. Var.
Horizontal Ground Velocities	INS	INS Valid and INS or TCN Nav Mode Selected.	AHRS & ADC	AHRS and ADC Data Valid and either INS Invalid or A/D Nav Mode Selected.
Vertical Velocity	INS	INS Valid, ADC Alt. Valid, ADC-INS Δ Alt. $<$ 2000 ft., and either INS or TCN Nav Mode Selected.	AHRS and ADC	ADC and AHRS Data Valid and either A/D Nav Mode Selected, INS Invalid, or INS Valid but ADC-INS Δ Alt. $>$ 2000 ft.
Radar Track Data	Radar	Radar Lockon	None	
True Airspeed	ADC	ADC Airspeed Valid	INS and Winds	INS Valid and ADC airspeed Invalid.
Turn Rate Acceleration	LCG	LCG Valid	None	

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Figure 3-3

SECTION IV
SUPPLEMENTARY DATA

TABLE OF CONTENTS

BORESIGHTING

The term boresighting refers to the alignment of avionics and armament components to a common aircraft reference plane. TO 1F-15C-2-3 contains the maintenance instructions for alignment of the Inertial Measurement Unit (IMU), the HUD and mounting base, the radar antenna, the 20mm gun. The objective of boresighting an airplane is to ensure the accuracy of the weapon delivery systems as follows:

a. The 20mm gun is boresighted to the gun cross of 2250 feet.
b. The radar antenna, IMU mount, and HUD mount are aligned to the aircraft body coordinate system. These systems are boresighted to ensure an accurate HUD display of antenna line of sight and provide accurate data to the CC.

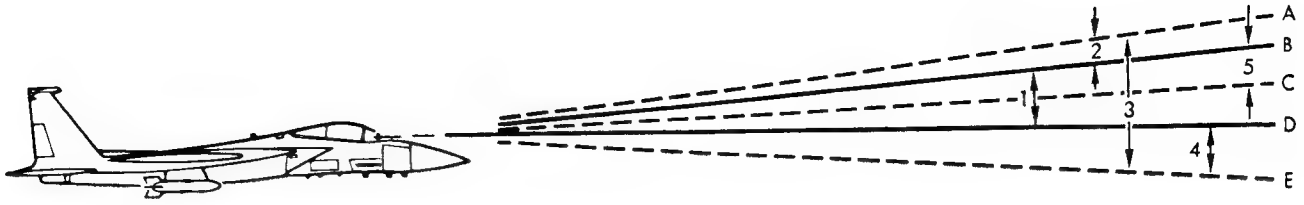
GUN HARMONIZATION

Theoretically, all gun projectiles should follow the same flight path or trajectory and should strike a common point. However, certain factors cause different projectile trajectories, thus causing impact in a defined area, rather than at a common point. This phenomenon is known as dispersion. Dispersion is caused by variations in manufacturing tolerances, barrel whip, changes in the statics and dynamics as the gun accelerates and decelerates, slight rate variations during steady-state firing, and variations in ammunition characteristics. The dispersion of the M61A1 gun produces an approximate 8-mil cone of fire.

SIGHT PARALLAX

The term parallax (figure 4-1), is defined as the displacement or separation between the optical sight reticle and the point at which the specific armament is suspended. A parallax sighting error for the gun is shown in figure 4-1.

WEAPONS SYSTEM REFERENCE LINES



REFERENCE LINES:

A. Gun cross line, zero sight line
B. Water line (WL), fuselage reference line, radar boresight line
C. Aim -9 missile boresight line
D. Aircraft flight path
E. Depressed pipper sight line

ANGLES:

1. Angle of attack
2. Gun cross elevation angle (2° or 35 mils above WL)
3. Pipper depression angle from zero sight line
4. Pipper depression angle from flight path
5. Aim -9 weapon depression angle (0.5° or 9 mils)

SIGHT PARALLAX, 20mm GUN

Vertical	2.47 Feet
Horizontal	11.68 Feet
Azimuth	5.63 Feet

15C-34-1-1-(115)

Figure 4–1

GLOSSARY

A

A/A – Air–to–Air

AAA – Anti–Aircraft Artillery

AAI – Air–to–Air Identification

ACM – Air Combat Maneuvering

ACP – Armament Control Panel

ACS – Armament Control System

A/G – Air–to–Ground

AGE – Aerospace Ground Equipment

AGL – Altitude above Ground Level

AGM – Air–to–Ground Missile

AGR – Air–to–Ground Ranging

AI – Airborne Intercept

AIM – Air Intercept Missile

AOA – Angle of Attack

AOJ – Angle of Jam

API – Armor Piercing Incendiary

ASE – Allowable Steering Error

AZ – Azimuth

B

BCN – Beacon

BIT – Built–In Test

BST – Boresight

C

CB – Circuit Breaker

CC – Central Computer

CL – Centerline

D

DF – Direction Finding

DPLR – Doppler

E

ECCM – Electronic Counter–Counter Measures

ECM – Electronic Counter Measures

El – Elevation

EMI – Electro–Magnetic Interference

EOD – Explosive Ordnance Disposal

F

FOV – Field of View

FPS – Feet Per Second

Fuselage AOA – The angle in mils between flight path and fuselage reference line

Fuselage Reference Line (FRL) – The horizontal plane of the aircraft, or water line, armament datum line, zero water line

G

G – Gravity Force

GCI – Ground Control Intercept

GMTI – Ground Moving Target Inhibit

H

Harmonization – Adjusting the gun and the HUD gun cross so that the center of the bullet pattern and the gun cross coincide on the same designated point at the most effective gun range (2250 feet).

HE – High Explosive

HEI – High Explosive Incendiary

HF – High Frequency

HI PRF – High Pulse Repetition Frequency

HOJ – Home–On–Jam

HSI – Horizontal Situation Indicator

HUD – Head–Up Display

Hz – (Hertz) Cycles Per Second

I

IFF – Identification Friend or Foe

INS – Inertial Navigation System

IP – Identification Point, Visual or Radar

IR – Infrared

K

GLOSSARY (CONT)

KCAS – Calibrated Airspeed in Knots

L

LAE – Lead Angle Error

LAU – Launcher Unit

LCG – Lead Computing Gyro

LI – Left Inboard, reference to munition rack location

LO – Left Outboard, reference to munition rack location

LOS – Line of Sight

LRS – Long Range Search

LRU – Line Replaceable Unit

M

MIL – Milliradian. One mil = 0.0573°, 1° = 17.45 mils, one mil subtends approximately one foot at a thousand foot range.

MRM – Medium Range Missile

MSEC – Millisecond, one MSEC = 0.001 second

MSL – Missile

N

NAV – Navigation

NCI – Navigation Control Indicator

O

OFP – Operational Flight Program, Computer Software

P

PD – Pulse Doppler

Pickle – The act of pressing the weapon release button.

Pipper – The optical sight aim dot

P_K – Kill Probability, expressed in percentage.

PPI – Plan Position Indicator

PRF – Pulse Repetition Frequency. A time measurement of how frequently a pulse radar repeats the transmit–listen cycle; the on–off cycle of the pulse transmitter.

R

Radar Mile – A radar mile is 6,000 feet, or the time required for one pulse of energy to be transmitted 6,000 feet and reflected back to the receiver (12.4 microseconds).

RAM – Raid Assessment Mode

Raster – Horizontal scan of the electron beam in a fixed TV format, used in the low PRF radar modes.

RBL – Radar Boresight Line, position of the radar antenna when in BST (Boresight). Zero's with the fuselage reference line.

RCP – Radar Control Panel

RF – Radio Frequency

RI – Right Inboard, reference to munition rack location

RIP – Radar Identification Point

RNG – Ranging

RO – Right Outboard, reference to munition rack location

RSC – Radar Set Control

RWR – Radar Warning Receiver

S

SPM – Shots Per Minute

SRM – Short Range Missile

SRS – Short Range Search

SS – Supersearch

SW – Sidewinder (AIM–9) (SRM)

T

TACAN – Tactical Air Navigation Set

TAS – True Airspeed; calibrated airspeed corrected for temperature and pressure.

TBL – Timed Barrel Line; a line extending from the center of a timed gun barrel bore to infinity. Used as a reference in harmonization.

TD – Target Designator

TDC – Target Designator Control

TEWS – Tactical Electronic Warfare System

T_f – Bullet Time–of–flight

GLOSSARY (CONT)

TRK — Track

Tgo — Computed prelaunch/postlaunch MRM time—of—flight.

V

VI – Visident

Video – Refers to the data displayed on a radar scope.

VS — Velocity Search

VSD — Vertical Situation Display

VTR — Video Tape Recorder

W

WL – Waterline; a plane of horizontal reference on an aircraft

X

XMTR – Transmitter

Z

Zero Sight Line – The pipper line of sight when the optical sight is set on zero mils depression; 2° above the fuselage reference line on this aircraft.

ALPHABETICAL INDEX